

Rock Products

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Acme of Sand-Lime Products

The Clayton Brick and Tile Co., Dubuque, Iowa, Manufactures Sand-Lime Brick, Inset and Floor Tile, Profile Stone Work, Culverts, Sewer Pipe, etc., Under German Process. Details of Unusually Modern Sand-Lime Brick Plant

By Charles A. Breskin

IT was a long-known fact that a moist mixture of sand and slaked lime becomes hard on being exposed to air, a process dependent upon the absorption of carbon dioxide. For many years blocks and bricks have been manufactured, depending upon this reaction, by simply molding a sand and hydrated lime mixture and exposing it to air. These were known as mortar brick, the sand mass being held together by common particles or crystals of calcium carbonate. An evolution of this was the sand-lime brick, in which the sand mass has a calcium or calcium silicate bond, the com-

bination between sand (silica) and lime (calcium hydrate) being brought about by the influence of steam.

The process for making sand-lime brick was discovered by Dr. William Michaelis in 1880, although mortar brick were made in New Jersey in 1860. The early history of the industry was fraught with innumerable difficulties and it is but recently that the industry has established itself on a sure footing and gained recognition from architects and building contractors.

In many parts of this country it is an indispensable product (where clay brick is

scarce) and has placed within reach of the users a durable, non-combustible building material—a home product with reasonable transportation costs. In many markets it is successfully competing with clay brick.

One of the latest and most modern plants erected in this country is that of the Clayton Brick and Tile Co., Dubuque, Iowa. The plant is at Clayton, Iowa, about 40 miles north of Dubuque, on the banks of the Mississippi river. Construction on this new plant started in the spring of 1921, but actual operation did not begin until the latter part of 1922, as much of the ma-



The Clayton Brick and Tile Co. plant from the Mississippi river. Note the silica rock quarry directly to the rear of the plant



Side view of plant in winter time. It has a daily capacity of 43,000 silica brick besides manufacturing other silica products

chinery was brought over from Germany and there were the usual delays. The sand-lime brick is manufactured under the "Berric" process; the tiles, profile work and other special products are made by the same German process. Steps have been taken to register the patent for the Berric system in the United States.

The Clayton Brick and Tile Co. is the outcome of the investigations of one of its organizers, Richard Kolck, Jr., of the sand-lime or silica products plants in Germany. Mr. Kolck spent 19 weeks studying various plants under very adverse conditions as the German operator is unusually secretive. However, with the co-operation he received from his uncle, one of Germany's largest operators, he was able to obtain some very definite data which found its culmination in the Clayton Brick and Tile Co.

The Germans have made rapid strides in the advancement of the sand-lime brick industry as well as in other silica products. In Berlin the sand-lime brick has been uncon-

ditionally passed for all building purposes. A face-sand or silica brick has been developed that is meeting with great favor. All colors and styles are made, including an enameled face brick. Profile stone (or architectural trim stone) work, inset and floor tile, imitation marble, culverts and sewer pipe are included in the itinerary of almost every silica product plant. The manufacture of these products is carried out on a more or less secretive basis, there being special methods and processes of various kinds. The Clayton company, in the short time of its operation, has been most successful in marketing its special products.

It was the writer's good fortune to visit this company's plant and salesroom. Seeing is believing; otherwise, it would have been difficult to convince the writer that what he saw at the Clayton plant was possible to do with silica, lime, cement and magnesia (calcined magnesite). Tile of every hue and texture; terrazzo flooring and marble that



A portion of exposed sandstone quarry face. The vein is 137 ft. thick and averages more than 99.3 per cent silica



A cave in the deposit that was worked as far back as 1852 for glass sand, which was shipped in barges down the Mississippi river to St. Louis

cannot be distinguished from the original product; enameled brick that is claimed to be even superior to the clay product, and profile work that is startling in its beauty.

The Silica Deposit

Clayton is one of the most interesting spots in the state of Iowa. It is situated within the driftless area, the surface being deeply intrenched by streams and its scenery diversified and picturesque. There are few more attractive scenes along the Mississippi river than those to be observed from the bluffs bordering the river.

The silica deposit of the Clayton Brick and Tile Co. is a St. Peter's sandstone setting directly to the rear of the plant in the form of a big bluff comprising some 40 acres. It has a vein 137 ft. thick and the exposed face runs to a distance of 1000 ft. The deposit is very pure, analyzing more than 99.3 pure silica unwashed.

St. Peter's sandstone is a coarse-grained rock composed of more or less well-rounded

grains of clear quartz. The particles of sand are held together loosely, and in a great many places the formation is little more than an incoherent bed of sand. With an increase of cementing material the rock becomes less friable and passes occasionally into quite a hard sandstone. At pits around Clayton the material is so incoherent that large fragments are readily broken up with a pick and smaller pieces disintegrated hydraulically. Some of the sandstone has a

very wide range of colors, varying from more common white or gray to many shades of yellow, red and chocolate brown. The sandstone outcrops as a comparatively narrow belt along the valley sides. It shows no traces of organic remains, and fossils are seldom found in the formation.

At the present time the company is operating on a level 125 ft. above plant elevation. The rock here is more or less friable, and hollow sand drills and dynamite loosen

the deposit so that it can be loaded into 1 cu. yd. Koppel end-dump tramcars with pick and shovel. After loading, the car is gravitated to a tippie and dumped into a chute leading to the sand storage house at the plant. The chute is 110 ft. above plant elevation and is inclined 52 deg. from the horizontal.

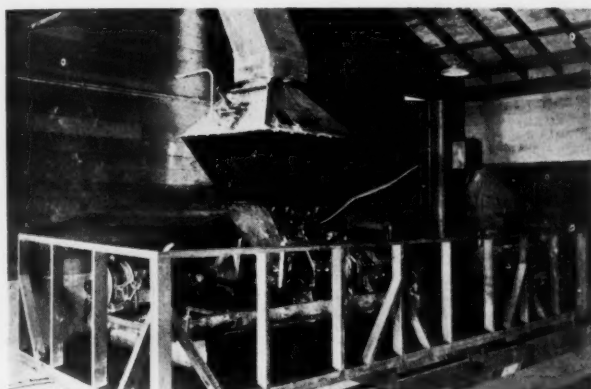
The sand house is 36x42 ft., with a capacity of 750 tons, which is large enough to keep the plant running for several days



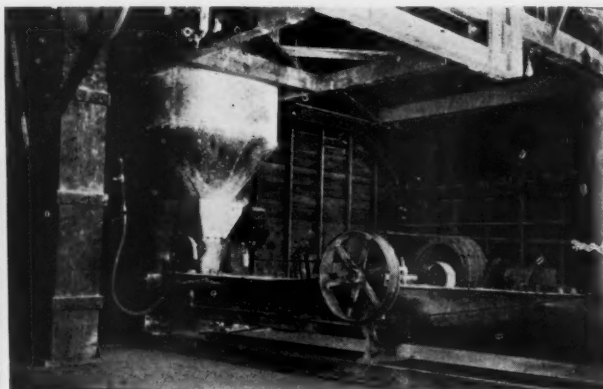
The tippie, sand chute and sand house. The sand chute is inclined 52 deg. from horizontal



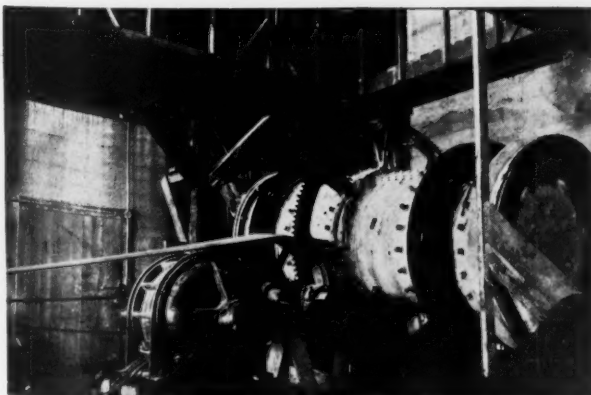
The poidometer used for measuring the silica sand. This is an automatic weighing conveyor machine



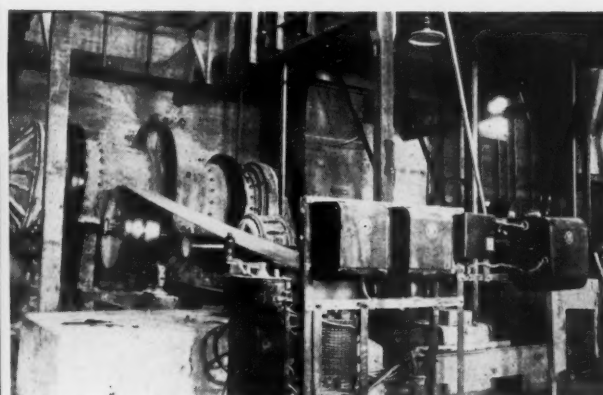
Battery of poidometers set in tandem and discharging into a common spout feeding the rod mill. The poidometer accurately measures the amount of sand and lime



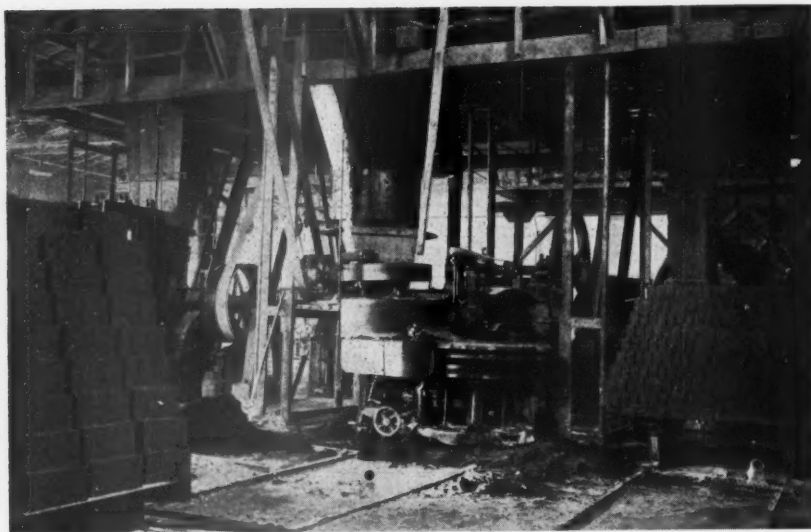
A continuous pug-mill type hydrator slakes the lime. It is pivoted on the feed end; the discharge end sets on wheels running on a circular track



This rod mill grinds and mixes the silica-lime mixture. It is filled with 11,000 lb. of rods, from 3 to 4 in. in diameter, which tumble as the mill revolves



Drum controls, motor and belt drive for rod mill, which revolves at the rate of 16.4 r.p.m. The resultant mix is from 80 to 200 mesh



The rotary brick press has a daily capacity of 28,000 brick. On each side is a turntable upon which a flat deck steel car sets

in case the quarry cannot be operated. It is fitted with steam pipes around its sides, so that excess moisture can be eliminated when the sand is too wet. A hopper wall construction automatically discharges the sand to a two-ton hopper which feeds a Schaffer poidometer.

Preparation of Lime

Although the proportion of lime used in making sand-lime brick is relatively small, its quality is of paramount importance. It must be of a high calcium content and perfectly hydrated before entering into combination with the sand.

The Clayton company purchases its lime in lump form, carload lots, from Quincy or Hannibal, Ill. The lime is unloaded by wheelbarrows and dumped into a Butterworth and Lowe pot crusher. It is crushed down to 1-in. size, after which it is reclaimed by a 14x4x7-in. bucket elevator of 30-ft. centers, discharging to an 18-in. belt conveyor of 25-ft. centers. The belt conveyor carries the lump lime to a four-ton hopper situated directly over the hydrator.

The hydrator is 25 ft. long, of the pug-mill type, with differentiated speeds on the two shafts. It is of the continuous type, with a capacity of five tons per hour. The feed end of the hydrator is pivoted while the discharge end is free to describe an arc, being fitted with wheels running on a circular track. With this arrangement it is possible to discharge the lime into any one of six openings leading to two silos, with a combined capacity of 120 tons. The hydrator is of Jackson & Church Co. manufacture and relatively dustless in operation.

As the lime is needed it is discharged by gravity to the boot of a bucket elevator directly between the two silos. The elevator is 30 ft. between centers and discharges to a hopper feeding another Schaffer poidometer. All the machinery is electrically interlocked so that in case the hydrated lime hopper is too full, the poidometers and all

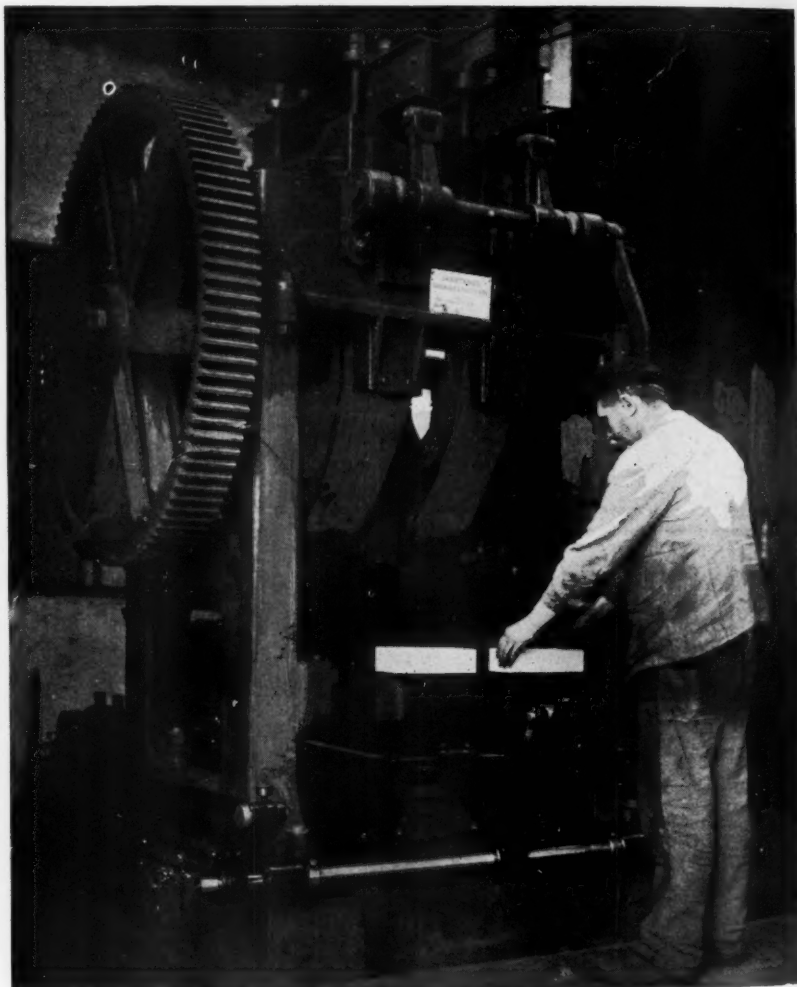
other dependent machinery in the unit automatically stop.

Grinding and Mixing of Material

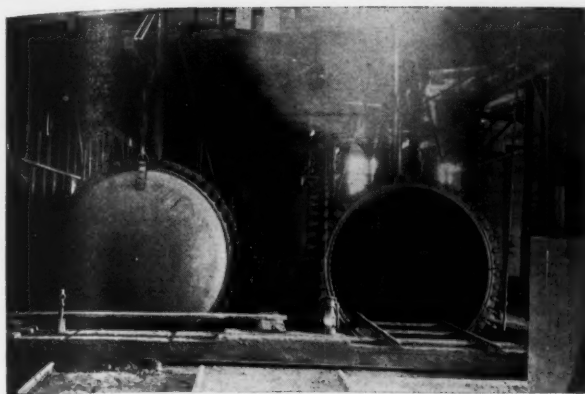
At this stage the material is ready to be mixed for the presses. This is one of the most important steps in the manufacture of the brick and is usually the determining factor in its quality. The lime and sand should be in intimate contact with each other so that the chemical reaction between them can readily take place. The sand should be evenly distributed throughout the mass, thus reducing the percentage of voids to a minimum.

Underneath the hopper bins holding the sand and hydrated lime is a set of Schaffer poidometers (which are automatic conveying and weighing machines) that correctly measure the proper proportion of raw materials. They are constantly in operation and discharge to a common spout feeding a 48-in. by 11-ft. Marathon rod mill.

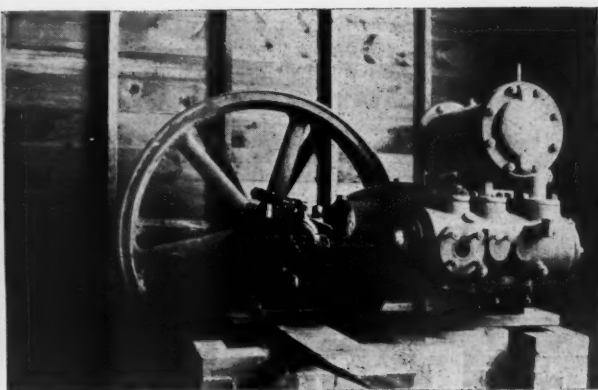
The rod mill has but recently been introduced in the sand-lime brick industry. The crushing and mixing are done simultaneously. The mill is a cylinder filled with 11,000 lb. of rods, from 3 to 4 in. in diameter, these rods tumbling and revolving as



The Dorstener upright automatic delivery brick press. It has a capacity of 15,000 brick per day



The hardening cylinders are 6 ft. 6 in. by 60 ft. Each holds 15,000 brick which are cured from 8 to 10 hr. under a 120-lb. steam pressure

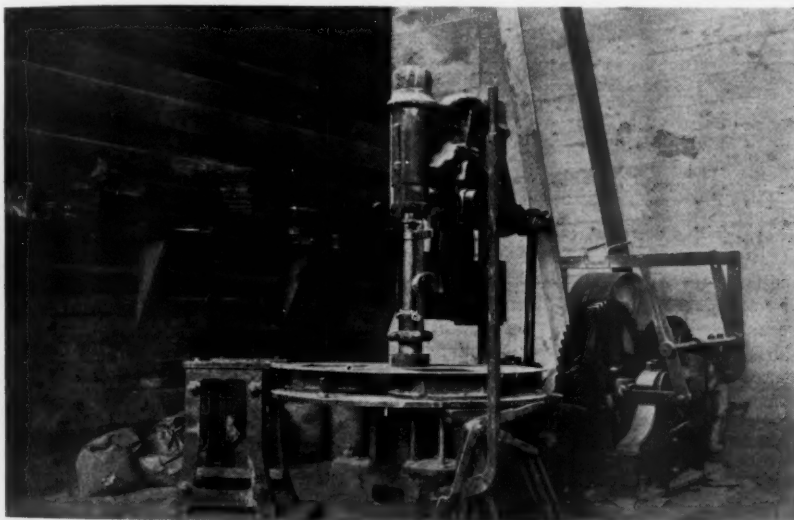


A German air-compressor which delivers 110 lb. air per minute to three pneumatic tamping machines for making culverts and profile stone work

the cylinder is turned. The resultant mix is very thorough, each particle of sand being evenly coated with a particle of lime. The

Hardening Cylinders

The brick as they are taken from the press are placed on flat-deck steel cars



Machine for manufacturing tile. This press has a rotary table and toggle-joint action which exerts a pressure of 570,000 lb. on the plate

mill has a rim discharge and a capacity of 17 tons per hour. It is belt driven from a 75-hp. motor with a speed of 16.4 r.p.m. The motor has a forward and reverse drive.

The discharge from the rod mill (80 to 200 mesh) goes to a bucket elevator of 28-ft. centers, which carries the material to a 24-ft. paddle conveyor, discharging to hoppers feeding the presses. An automatic feeder is provided in each hopper and this lets the required amount of material into each press. The only water in the mixture is that contained in the original sand and in the lime hydrate.

The company has two presses, one a rotary with a capacity of 28,000 brick per day, and the other a German press known as Dorstener upright with automatic delivery. The Dorstener has a capacity of 15,000 brick per day and is claimed to mold the brick under a 680,000-lb. pressure.

and by means of a turntable the car is turned in any desired direction. When the proper number of brick have been placed on the car it is transferred to the main track and trucked to the hardening cylinders. There are two hardening cylinders, each 6 ft. 6 in. by 60 ft., with a capacity of 15,000 brick each. When the kettle is full the head is bolted on, and steam gradually admitted until it has reached a pressure of 120 lb. per square inch. This pressure is maintained from 8 to 10 hr. and then the steam is blown off. The brick are then taken out and loaded direct into cars or taken on the loading platform. A roller conveyor is used to load from the platform to the box cars.

Steam for curing and power purposes is generated in a 150-hp. water-tube boiler. A 200-hp. Murray Corliss self-condensing and oiling steam engine is direct-connected to a 135-hp. generator which furnishes enough current to run all the electrical equipment. The plant is entirely electrically equipped, the total horsepower being 155. Of this number practically 50 hp. is used only intermittently.

The foregoing takes in the machinery and



The superintendent's home—a silica product. Walls and foundation are white common and buff silica brick. Red colonial sand-lime roof tile



Some imitation stone work. Any color or combination of colors or form can be produced

process required to make the white sand-lime or silica brick. The company also makes a buff brick, using ochre for the coloring medium. It is added at the poidometer measuring the lime. A colonial red brick is also manufactured.

Tile, Profile and Special Work

The inset and floor tile, profile stone work, marble slab, roofing tile, caps, molding, etc.,



Roofing tile made in green or red. The tile hangs by its own weight by 1x2-in. strips nailed to the roof joists or rafters

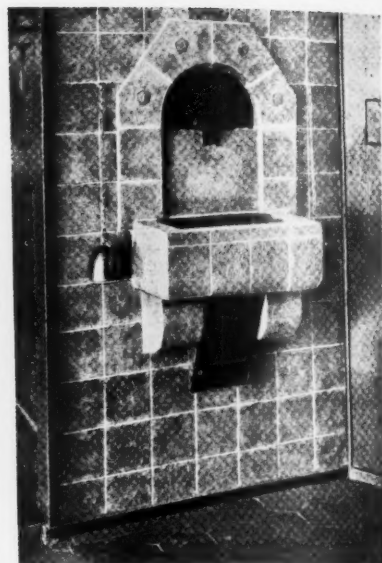
are manufactured under the "Beric" system.

Foreign dyes are used exclusively for all color work, the greens coming from Holland and the reds from England. A domestic carbon is used for black. The colors are prepared and ground in an egg-shaped ball mill with an oscillating motion. Any tint is secured by mixing these three basic colors.

In manufacturing the tile, the base is a mixture of silica, lime, magnesia and portland cement. These ingredients, in the proper

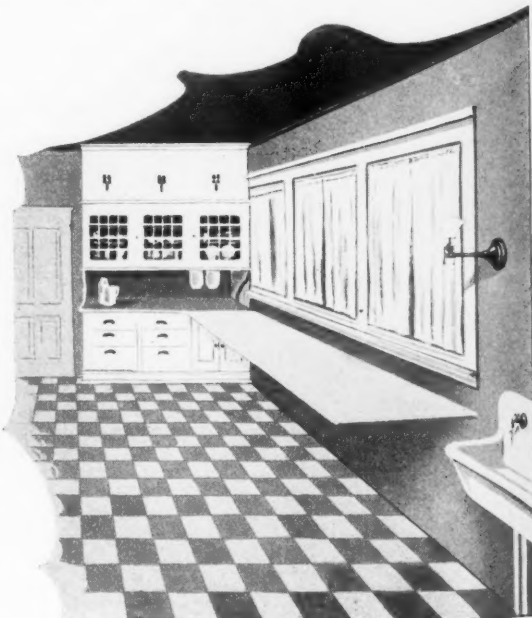
proportions, are mixed in a German mixer, wet-pan type, bottom discharge with a capacity of eight tons per hour. A batch is prepared in a skip hoist which feeds the mixer. The material is ground for six or seven min. to a consistency of from 160 to 200 mesh. The discharge is taken by wheelbarrows to the tile press, another machine of German manufacture. This press has a rotary table and toggle-joint action which creates a pressure of 570,000 lb. on the plates.

The dies for the floor and inset tiles



Floor and inset tile work on a drinking fountain

are manufactured in Germany also, it being possible to reproduce any color or combination of colors. The face is made on the bottom of the plate, after which the body is put on (lime, silica, magnesia and cement). The colors for the face are fed from an automatic arrangement on top of the machine. An automatic device regulates the depth of the tile and either a 7x7-in. or 9x9-in. tile can be produced. The press has a capacity of 300 sq. ft. of tile per day and delivers the tile face up. The operator sets it in a rack where it remains for 12 hr., after which it is put in the hardening cylinders and subjected to the same treatment as the sand-lime brick.

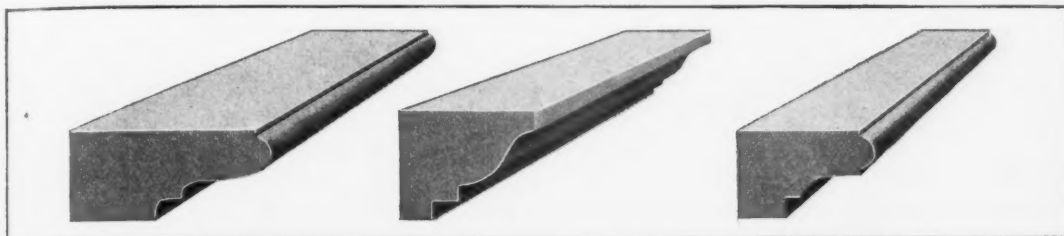


Floor tile in a kitchen

The whole process is very complicated and highly sensitive to temperatures and

warping. It has 1½ times the wearing quality of marble and will show no air lines.

two colors, either red or green. The mechanical construction is unique in its simi-

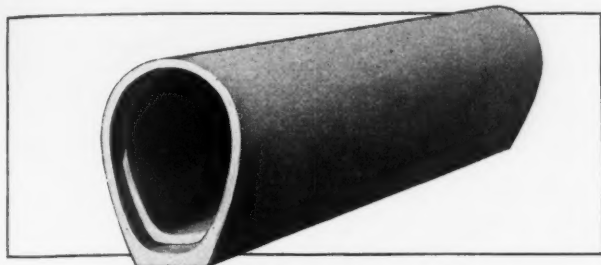


Example of cornice work. The company manufactures any profile stone work to conform to architects' design. Also marble slab work, slab insets, garden sets, sills and caps, molding, etc.

drafts. The magnesia must undergo special treatment before being put into the mix.

The tile is so much like marble that it takes an expert to tell the difference.

plicity in being constructed to merely hang by its own weight by 1x2-in. strips nailed to the roof joists or rafters.



A uniform culvert pipe, self-cleaning; will stand 50,000 lb. pressure on crest without breaking

The finished tile is claimed to be absolutely uniform, with no shrinkage, bending or

man pneumatic tamper is used, so regulated that the pressure is evenly distributed over the surface. The material is automatically distributed in the mold and rammed in courses. It is hardened and cured in the same manner as the tile. Any color combination may be used. The resultant product can hardly be distinguished from Bedford stone.

In manufacturing profile or imitation cut stone work the mixture is practically the same as that used for the base of the tile. The design conforms to architects' specifications and the material is molded in the same manner as a pattern is rammed into a mold in foundry work. A Ger-

Organization

Fred A. Henker, Dubuque, Iowa, is president of the Clayton Brick and Tile Co., W. H. Meuser is vice-president and Richard Kolck, Jr., secretary-treasurer and general manager. The superintendent is Bernard Elsner, a technical man who spent several years erecting and operating plants in Turk-estan, Germany and Finland.

The company has its general offices in Dubuque and sales offices in LaCrosse, Wis., and Mendota, Ill. At the present time plans are being prepared to perfect its dealer organization and market its products on a broader basis.



Richard Kolck, Jr., secretary-treasurer and organizer of the company



Ornamental work on inset tile

The roof tile, culverts and other special work are made practically the same as tile and imitation stone work, the only difference being in the machine and molds. The culverts will sustain a pressure of 50,000 lb. on the crest without breaking and are of the self-cleaning type. Roofing tile is made in



Bernard Elsner, technical man and superintendent

The Design of Sand Plants

By Edmund Shaw
Consulting Engineer, Chicago

Part II—Plant Layout and Construction. No. 1: How Choice of Materials and Equipment Is Influenced by First Cost and Salvage Value

IT IS not enough that a sand plant should be equipped to wash the sand free from clay and settle it, and to separate it into sized products where this is necessary. There must also be well-planned arrangements for the storage of excess product until the market will take it and, above all, a good method and good equipment for loading the product into railway cars and trucks.

The importance of these things comes from the fact that sand is sold at a low price, and usually there is not much margin between production cost and selling price. So every extra handling of the product is to be avoided. Some producers, who have had years of experience, claim that there is no profit in storing sand, because the cost of maintaining storage yards and of handling into and out of storage eats up all the margin between the selling price and the original production cost. But this is not the general opinion, and even if storage were unprofitable, directly, it would still be necessary to store in order to hold the trade during the periods of no production and of a greater demand than the regular daily output of the plant could fill.

Plant Cost the First Consideration

About the first matter that must be considered by the man who would build and operate a sand plant is the amount that is to be spent for buildings and equipment. There is more to this than the amount of money that is at his command. The first cost is just as much a part of the production cost as the daily wage that is paid out to a workman. And the proportion of first cost which must be charged to each ton produced is something which should be decided at the very beginning.

Amortization is the name given to that part of the production cost of each ton, or car, or whatever unit is used, that represents the first cost of the plant and equipment. It is a particularly important figure when we are dealing with those industries which produce raw materials directly from the earth. The manufacturer who builds a textile mill or a shoe factory may figure that he is establishing a business that will last throughout his lifetime and be handed on to his son and perhaps his son's son. The machinery may wear out and the buildings may need replacing after 10 or 20 years, but the business itself will go on, and if the proper provision has been made for replace-

ment funds, the buildings and the equipment will be repaired and replaced as the need arises, so that at the end of any period of time the business will find itself in as good, or in better, shape physically as it was in the beginning.

This is not the case when a mine, a stone quarry or a sand and gravel pit is to be worked. All of these have their physical limitations—length, breadth and thickness—so that for practical purposes the end of the operation is foreseen from the beginning. No matter how large the deposit may be, the number of tons it contains is a measurable quantity, and each ton that is extracted reduces that quantity by one. Hence, as the work proceeds, the value of the deposit lessens and such properties are rightly described as "dying assets."

Not only is the value of the deposit which is to be worked a dying asset but practically all of the structures and machinery employed in the operation. It is only in rare instances that anything of much value can be sold after the operation is completed. The structures will not usually pay the cost of tearing down and the machinery at the most has only junk value. This is the ordinary case but, as will be explained later, it is not always necessary that such should be the case. As a matter of caution, however, it should always be assumed that all the value in buildings and equipment is exhausted when the deposit is exhausted.

Finding the Assumed Life of the Deposit

It is evident that the assumed life of the deposit may be found by dividing the estimated number of tons it contains by the number of tons which it is proposed to take out per day or per year. This fixes the amortization term for the deposit as a whole. We can usually take the same term for the permanent structures. But with equipment it is different. Machinery around a sand plant wears out rapidly, even in those parts which do not come in direct contact with the sand that is produced. The winds blow sand into bearings and the business is of such a nature that it is hard to keep the machinery and equipment neat and clean. These things have to be kept in mind in figuring first cost into the production cost per ton.

It would be a foolish error to erect expensive steel and concrete structures to work

a deposit which had a probable life of only three or four years, and it would be an equally foolish error to build cheap and flimsy wooden structures on a deposit which promised 15 to 20 years of steady production. The same rule holds good with machinery. For short-lived operations it may be the soundest economy to purchase cheap machinery which has a short life or a high operating cost. But it would be almost criminally wasteful to purchase such machinery for operations which were to extend over a long term of years.

In dealing with machinery and equipment we have to consider each piece by itself, and to divide its estimated life of service by the number of tons for which it will serve, rather than by the number of tons in the deposit.

Length of Machinery Life a Factor

A matter which is often overlooked in considering the length of life of a piece of machinery is the possibility of its being rendered obsolete by the invention of a new machine or by a change in method of treatment. Sand and gravel practice seems at the present time to be pretty well fixed but the possibility of change is always present. The same was true of the somewhat similar industry of ore concentration. Plants had been built, one very much like another, for many years. Then suddenly came newly invented machinery which was much more efficient than the old. It happened at this time that a great plant, costing more than a million dollars, was under construction and the machinery for it was already purchased and on the ground. A lot of it was thrown into smelting furnaces (so that the iron could be used for flux) without even removing the machines from the packing cases. This destruction of new machinery was warranted because the newly invented machinery was so much more efficient that its use would pay the cost of replacement within a very short time.

Sand and gravel machinery is extremely simple but it is quite possible that even now a screen is on the market that will make the familiar rotary screen as out of date as a flintlock musket.

It has been mentioned that it was not always necessary that plants should have no salvage value when the deposit was exhausted. A good salvage value may be obtained for the structures when they are

designed so that they can be readily dismantled and re-erected and when they are built of a material that has a longer life than that of the deposit.

Use of Structural Steel

These conditions are filled by the use of structural steel. The material will last far beyond the life of any ordinary deposit and the design may easily be made so that all the field work can be put together with bolts instead of rivets. When the deposit is exhausted all that is necessary is to dismantle it and load it on cars and move it to the new plant site. All that has to be abandoned are the concrete footings on which the steel columns rest.

This method of design and construction may be adapted to any sort of plant, even the largest plants. But it is particularly adapted to those plants which are of the skeleton form; that is, those which use ground storage in place of bins. As timber gets higher in price and as carpenters' wages soar, steel is more and more used in construction of industrial plants of all kinds. It is probable that it would be used to a far greater extent if it were possible to obtain deliveries of fabricated steel in a short time. The way things have been going lately, steel deliveries have meant months of waiting, and in cases of which the writer knows the plan of building of steel was abandoned because delivery could not be had until the season was far advanced.

But the use of steel is usually to be recommended wherever possible. It is not only cheapest in the long run, it is often cheapest in first cost. This, of course, depends on the locality and the transportation difficulties. It is generally true of localities in the Middle West which are near the larger cities, and these are the localities in which many plants are being erected at the present time.

Concrete structures can hardly be built so as to have any salvage value, and, bearing in mind what has already been said about amortization and first cost, it is plain that their use is to be recommended for only the longest lived deposits and operations of some magnitude.

The old standby in the way of plant building materials is timber. It can be bought anywhere and for most sizes quick deliveries may be had. Its use is familiar to the workmen, not only the carpenters and millwrights who erect the plant but the men who will repair the plant and keep it in order after the plant is erected. The life of a timber structure may be long or short, according to the care that is taken in designing it and building it, and the effort that is made to maintain it in good condition after it is erected.

Very small things may affect the life of a timber structure. For example, one builder, who has constructed a number of plants, found that he could nearly double the life of timbers by painting with wood preservative the surfaces that were to lie against

one another, after joining. The use of preservative outside the joint was found to be of little value as compared with its use within the joint, where it could not be placed after the structure was erected.

Formerly it was possible to obtain larger timbers than can be bought easily today. The use of such large sizes as 12x16-in. and 16x16-in. is pretty limited today and such timbers command a high price. The effort of designers now is to get away from their use and in some cases steel beams have been substituted with good effect. Timbers are well adapted for use as posts for they will sustain heavy loads per square inch on the ends of the fibers. But where they are used as beams they must be made deep and

heavy to support the weight over any considerable span. They have another weakness in that the bearing surface on the under side of the beam, where the beam rests on posts, must be large in order that the beam shall not fail by crushing under the load.

What has just been said applies particularly to beams under bins, as that is where they have to support the greatest loads. The use of steel for beams in combination with wooden posts and sides for a bin is rather unusual and gives the designer some awkward joints to handle, but bins of this type have been constructed and have been found satisfactory.

(To be continued)

Molding Sand Research

MOST opportunely the work of the Joint Molding Sand Research has been aided by a contribution of \$1000, just received by Chairman R. A. Bull from the American Foundry Equipment Co., says *Iron Age*. No addition to the fund had been made since the original amount of \$4300 was voted for this purpose by the directors of the American Foundrymen's Association. It is estimated that \$9000 will be needed to complete the work laid out.

The Joint Committee on Molding Sand Research now has two research engineers in its employ and will soon have another. These engineers supplement the part time work of the 24 sub-committee members and of other investigators not on the joint committee who have collaborated at many foundries and at the laboratories of the Bureau of Standards, Cornell University and the University of Illinois.

A vast amount of work has been done in developing satisfactory methods of testing. Many varieties of sand have been used and their behavior in some cases showed interesting phenomena. Methods of testing have been conditionally approved and are now under final review. It is hoped that announcement can be made at the American Foundrymen's Association convention at Cleveland, early in May, of testing methods tentatively adopted by the joint committee for one year's trial. The methods are divided into two classes, essential and supplementary. The former are for determining bonding strength, cohesiveness, permeability and fineness. The supplementary methods are for the determination of dye absorption and for making chemical analyses.

The sub-committees on conservation and reclamation and on geological surveys have been busy also, and they are expected to present reports at the Cleveland convention.

The joint research was organized by the American Foundrymen's Association, assisted by the National Research Council. The work was started in December, 1921. The American Society for Testing Materials has three members on the committee, the Bureau of Standards has a like number,

and the Bureau of Mines, the Navy Yard at Washington, and the Canadian Department of Mines are all officially represented. There are 48 members of the joint committee, and the personnel is exceptionally strong. Ten are metallurgists and physicists of high standing, six are steel foundrymen, six are malleable foundrymen, six are gray iron foundrymen and five non-ferrous foundrymen. Five are geologists, six are sand producers and six are refractory experts.

The committee reports, which will be presented at the two molding sand sessions at the Cleveland convention, are looked forward to with particular interest.

Marquette Buys the Cape Girardeau Cement Co.

ANNOUNCEMENT is made by the Marquette Cement Mfg. Co., Chicago, that it has purchased the plant, stock, and goodwill of the Cape Girardeau Portland Cement Co. of Cape Girardeau, Mo. This purchase extends the field of operation of the Marquette company and augments its ability to more satisfactorily serve its customers.

The Cape Girardeau company, with a plant and offices at Cape Girardeau, has an output of some 25 cars per day and employs 200 men. The Edward Hely Crushed Stone Co.'s quarry adjoins the former and is the cement company's source of rock supply.

Bluffton-Lewisburg Co. Purchases Hancock Stone Co.

THE purchase of the Hancock Stone Co., Findlay, Ohio, located on the T. & O. C., B. & O., L. E. & W. and Big Four railroads, has been purchased by the Bluffton-Lewisburg Stone Co., Lima, Ohio.

J. R. Yearwood, sales manager, states that "We are going to maintain our standard of service and quality of rock, and with the addition of this plant we are able to assure even greater and better service than heretofore."

A Study of Lime Kilns

II—Raw Materials—Limestones

By Arthur E. Truesdell

Consulting Engineer, Pittsfield, Mass.

WHILE the carbonates of calcium and magnesium exist in nature in many differing forms, and oyster shells and even pearls are said to have been burned into lime, practically all the lime commercially made is calcined from limestones. These rocks, of marine origin, vary very markedly in appearance, density, and color. In addition, they may have been metamorphosed by heat and pressure into marble or other crystalline forms, such as calcite and Iceland spar.

The oxides of calcium and magnesium are the useful things we seek, and since they come from their respective carbonates, we class other substances in the rock as impurities. Such rocks as carry over 5 per cent of impurities are rarely burned, as the impurities not only detract from the purity of the lime, but many times combine in burning with part of the lime to form inert compounds, or are fused by the action of the heat into small particles which never slake, or "pit," later with destructive effects. The yield in hydrate and causticity of such limes is small.

Many kinds of impurities are found in most rocks, but most of them in small amounts in the commercial stone. The bearing of the presence of the minor impurities in the stone on the lime made from it furnishes a fertile field for chemical research. Laughlin* has pointed out the value of more complete analyses of our rocks. It is likely that when our knowledge has been extended through the study of complete analyses and microscopic tests of limestones that some predictions can be made about the characteristic of the lime made from each. At present the only reliable test of value is the actual calcining of samples, preferably in commercial quantities, and testing the product. Fortunately this procedure is simple and cheap.

The effects of the geological age of the limestone, nature of its deposition, metamorphosis and other possible items of its physical and chemical history upon the characteristics of the lime burned therefrom will be investigated in time. Little is known about them at the present time.

Most of the minor impurities are brushed aside today and attention given to the greater and common ones of silica (SiO_2),

alumina (Al_2O_3) and iron oxide (Fe_2O_3). The silica and alumina, although they generally affect the physical appearance of the rock, are detected by analysis as to quantity. The iron oxide nearly always shows itself to the eye in the red or brown cast it gives to the stone and the lime made from stone containing it. Vegetable matter (as carbon) gives blues and blacks, which disappear on burning.

The remaining content (95 per cent) of the stone is made up of the carbonates of calcium and magnesium. If only 5 per cent of magnesium carbonate is present, the stone is known as a high-calcium rock. If it contains upward of 30 per cent of magnesium carbonate, we call it high magnesium. Nearly all of the limes produced commercially are calcined from one or the other of these two classes of rock.

Experience in burning is the sole guide to the sorting of the rock in most quarries, especially where veins varying in composition are found. Workmen in such quarries become skilled in detecting kinds that will not make good lime, although in some cases very sharp eyes are required.

Thermo-Chemistry

Energy of Materials—A great many years after the discovery of lime and how to make it, some of the laws governing chemical reactions were discovered and formulated. For a long time it was known that heat (a form of energy) had to be supplied from some outside source to accomplish some chemical changes, while other chemical changes generated heat. After a time it was found that no chemical change occurred unless there was heat lost or

change. It has become customary to consider the heat content of each chemical element as zero and refer compounds to this base.

The Calorimeter—If we carry out the chemical reaction in a closed metallic case submerged in water and know the weights and temperatures of all the materials in and about the case, we can calculate the increase or decrease in heat present. Such a heat meter is known as a calorimeter and has become a very accurate and useful instrument among chemists and engineers. We can find by its use the heating value of the fuel we are using and somewhat indirectly the heat necessary to break up (dissociate) a pound or a ton of calcium carbonate. This instrument, then, will enable us to determine kiln efficiencies and to compare directly different styles of kilns.

Since the calorimeter uses water to absorb or give up heat to the reacting substances, the unit used becomes that amount which will raise 1 gram of water 1 deg. Centigrade and is called a Calorie (small). But as the gram is only 22/10000 of a pound, engineers are accustomed to use instead the kilogram (1000 times larger), calling the corresponding heat unit the Calorie (large). The English units of pound, degrees Fahrenheit, and the B.t.u. (British Thermal Unit) can of course be used in these calculations, but the metric units adapt themselves more readily to the calculations, and are more generally used.

Determinations made directly and indirectly with the calorimeter have given us the following formative heats from the elements for the major substances concerned in the calcining of limestone.*

Calcium carbonate (CaCO_3)	= 273850 calories per 100 grams
Calcium oxide (CaO)	= 131500 calories per 56 grams
Calcium hydrate ($\text{CaO} \cdot \text{H}_2\text{O}$)	= 215600 calories per 74 grams
Magnesium carbonate (MgCO_3)	= 269900 calories per 84 grams
Magnesium oxide (MgO)	= 143400 calories per 40 grams
Carbon monoxide (CO)	= 29160 calories per 28 grams
Carbon dioxide (CO_2)	= 97200 calories per 44 grams
Water (H_2O)	= 69000 calories per 18 grams

gained by the substances changing. It is comparatively recently that changes have been studied from the energy standpoint and the laws of thermo-chemistry laid down. We know no way of determining the absolute energy of a substance, but we have been able to measure the absorption or generation of heat taking place in chemical

Finding the Heat of Chemical Reactions

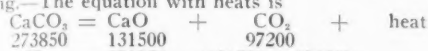
—Since no substances are lost chemically during chemical change, chemists make use of equations to show substances used and formed with their quantities. We can use heat units with the equations for the same

*Laughlin, G. F.: "Needed, Complete and Reliable Analyses of Limestones." *Rock Products*, September 10, 1921.

*Richards, Joseph W.: "Metallurgical Calculations," Chap. II.

reason, and thus find the amount of heat appearing or disappearing. To illustrate this, suppose we follow the heat involved in calcining one kilogram of calcium carbonate into calcium oxide, thence in slaking the oxide into hydrate, and finally in hardening back again into the carbonate.

Calcining.—The equation with heats is



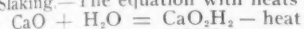
$$273850 \quad 131500 \quad 97200$$

$$\text{Heat} = 273850 - (131500 + 97200)$$

$$= 45150 \text{ calories per 100 grams of CaCO}_3$$

$$= 451.5 \text{ calories absorbed per kilogram of CaCO}_3 \text{ dissociated} \quad (3)$$

Slaking.—The equation with heats is



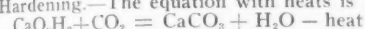
$$131500 \quad 69000 \quad 215600$$

$$- \text{Heat} = (131500 + 69000) - 215600$$

$$- \text{Heat} = 15100 \text{ calories per 56 grams of CaO}$$

$$269.6 \text{ calories released per kilogram of CaO, equivalent to 151.0} \\ \text{calories per kilogram of the original CaCO}_3 \quad (4)$$

Hardening.—The equation with heats is



$$215600 \quad 97200 \quad 273850 \quad 69000$$

$$- \text{Heat} = (215600 + 97200) - (273850 + 69000)$$

$$= 30050 \text{ calories per 74 grams of CaO}_2\text{H}_2 = 406.1 \text{ calories released}$$

$$\text{per kilogram of CaCO}_3, \text{ equivalent to 300.5 calories per kilogram} \\ \text{of the original CaCO}_3 \quad (5)$$

Thus we see that the heat absorbed in burning (451.5 cal.) is afterward released; one-third in slaking (151.0 cal.) and two-thirds in recarbonating or hardening (300.5 cal.) so that the heat content is the same at the end as at the beginning, as indeed it

must be since we come back to the same substance.

Of course in the hardening process the lime is generally diluted with sand or other aggregate, and the process is so slow that the release of heat is not appreciable. However, the heat released in hardening lime

growth and nitrogen content resulted.

Field studies indicated that Colby silt loam soil requires inoculation and liming before good crops of alfalfa can be grown. Inoculation of soil at Marshfield resulted in a crop increase of 67.1 per cent. When inoculation was reinforced by liming, the increase amounted to 120.4 per cent. The inoculated crop contained 87.7 per cent more nitrogen than did the control. The crop grown on inoculated soil treated with three tons per acre of ground limestone contained 160.2 per cent more nitrogen than did the control. The percentage of nitrogen was markedly increased by inoculation.

A study of the nitrogen content of the soils at the beginning and at the end of the experiments showed that a large percentage of the nitrogen in the crops comes from the soil. In only a few cases was there an actual gain in nitrogen to the soil due to cropping the alfalfa and clover (portion above ground cut and removed), and most of these gains were in the Plainfield sand. Inoculation for alfalfa and in some cases for clover increased the amount of nitrogen fixation from the air by these plants.

Magnesia and Hydrochloric Acid from Waste Chloride

MAGNESIUM chloride is a waste product in the manufacture of common salt and other chemicals. It has an extensive use in the oxy-chloride cement industry—the patent flooring cements and stucco. The magnesia with which it is used, however, comes chiefly from the West coast or from Austria.

A German patent has been granted for a process by which magnesium chloride may be converted into magnesium oxide—magnesia—and a very valuable by-product—hydrochloric acid.

The magnesium chloride is mixed with pulverized or precipitated magnesium carbonate, or magnesite, and exposed to steam at a high temperature. The hydrochloric acid (HCl) is quickly driven off and the magnesia (MgO) is left as a powder. A mixture of magnesium carbonate (magnesite, CMgCO_3), magnesium chloride (MgCl_2) and calcium carbonate (limestone, CaCO_3), or a mixture of MgCl_2 , CaCO_3 and MgSO_4 (magnesium sulphate) may be used.

Burning Lime with Garbage Incinerators

A BRITISH patent has been issued for a scheme to burn lime at town refuse incinerators. The limestone, or the lime, is mixed with the ash from the burned refuse, and subsequently hydrated with water or steam. It is claimed a cement may thus be produced.

Liming and Inoculation Helps Crops

IN their field and greenhouse studies with alfalfa and red clover on acid silt loam and sand soils, E. J. Graul and E. B. Fred, as reported in Wisconsin Station Research Bulletin 54, have arrived at the following determinations:

Calcium carbonate when applied to acid Colby silt loam which had not been cropped for many years increased the yield of and the total nitrogen in alfalfa. The largest applications did not always produce the largest yields. From 2.5 to 7.5 tons per acre of calcium carbonate gave increases in yield nearly as large as where larger applications were made. When three crops were added together, an increase of 70.3 per cent in crop yield and of 79.4 per cent in nitrogen content resulted when 10 tons per acre of calcium carbonate were added. The percentage of nitrogen in the limed series was increased with few exceptions. The addition of phosphorus and potassium to virgin Colby silt loam did not give increases sufficient to warrant recommending their use for alfalfa.

The results obtained in the greenhouse when cropped Colby silt loam was used indicated that these soils need inoculation, liming, and undoubtedly in many cases phosphatic fertilization. Inoculation alone

increased the yield 15.6 per cent and where liming and inoculation were supplied the increase amounted to 49.7 per cent. Where the soil was treated with lime and inoculated, the increase in nitrogen content amounted to 52.3 per cent.

Very marked increases in crop yields and in nitrogen resulted from inoculation and liming and the use of phosphorus and potassium of Plainfield sand. Inoculation alone nearly doubled the crop yield. Calcium carbonate in addition to inoculation resulted in increasing the yield 182.8 per cent.

The nitrogen of the crops that were inoculated was 171.2 per cent greater than that of the untreated control. Where 2.5 tons per acre of calcium carbonate were added in addition to inoculation, the increased crop yield was 310.7 per cent more than the control. In nearly every case inoculation increased the percentage of nitrogen in the roots.

Because the soil was naturally infected with the clover bacteria, this crop did not show a uniform gain in yield and nitrogen from inoculation. The addition of phosphorus and potassium greatly increased the yield and total nitrogen. Where lime was added in addition to phosphorus and potassium, no material increase in crop

(To be continued)

Chattanooga's New Cement Plant Progressing

Signal Mountain Portland Cement Co. Has a Fine Start on Its Quarry. Practically All Foundations for New Plant Have Been Poured and Steel Erection Begun. Ground Warrants Gravity Operation

WORK on the first unit of the Signal Mountain Portland Cement Co.'s new plant near Chattanooga was well under way on February 14 when a ROCK PRODUCTS editor visited the plant site with A. C. Deer, designer and construction manager, who is

which will remove the finished product into storage. With this comparatively small amount of elevating equipment an unusually low production cost is expected.

Equipment to be installed will include one No. 21 Allis-Chalmers gyratory crusher, two

clinker and 27,500 tons of stone, clay, coal and gypsum.

Officials claim that, due to the gravity operation of its plant, the company will have a labor cost of .33 man-hours per barrel of cement manufactured and shipped. This



Two views of the early construction. The tapered foundations are for the sides of the 80x650-ft. storage

also vice-president and general manager of the Peninsular Portland Cement Co., Cement City, Mich.

The quarry, which is located on one of the foothills of the Signal Mountain range, has been opened approximately 600 ft. and its development has been rapid, considering the length of time it has been worked. The first work done on the property was the opening of the quarry so that stone for concrete work could be procured economically and conveniently. A standard gage track from the quarry to the plant site was laid at that time which will serve permanently both during the construction and operation of the plant.

Practically all foundations for the first unit were completed at the time of the visit; the structural steel was on the ground, and the compressed-air equipment was being installed for the erection of the steel. No machinery, other than that employed in construction, was on the ground, as the company has asked its equipment manufacturers that deliveries be made only as the machines are needed, so that they may be unloaded from cars direct to their foundations. It is estimated that 5000 cu. yd. of concrete and 900 tons of structural steel will be used.

The plant when completed, officials of the company say, will be of gravity operation throughout, employing but two elevators,

No. 6 Williams Jumbo crushers, four 11x175-ft. Allis-Chalmers kilns with 8x70-ft. coolers, one 26-ft. Allis-Chalmers wash mill, four 7x22-ft. Allis-Chalmers compartment mills and one Shepherd overhead traveling crane equipped with a 2½-yd. bucket to take care of stone, clay, coal, clinker and gypsum in an 80x650-ft. storage. This storage, it is estimated, will accommodate 150,000 bbl. of

cost will be 59 per cent less than the 1921 average labor cost of 82 plants, which was .816 man-hours per barrel.

It is expected that the plant will be in operation some time in June of this year. The following are the officers: President, John L. Senior, Jackson, Mich., president Peninsular Portland Cement Co., Cement City, Mich.; vice-presidents, C. S. Steward



Early development of the quarry. The crushing plant at the right is a temporary unit

and J. L. Caldwell, both of Chattanooga; treasurer, J. P. Hoskins, Chattanooga; secretary, Ralph Law, Chattanooga. Directors: W. A. Sadd and C. W. Howard, Chattanooga; Charles Closs, Webster City, Iowa; D. F. McPherson, Chicago, and F. A. Stephenson, president, Ideal Sand and Gravel Co., Mason City, Iowa.

J. I. McCants, formerly associated with

the Standard Portland Cement Co., Leeds, Ala., has been appointed sales manager of the new company; A. C. Deer, vice-president, Peninsular Portland Cement Co., Cement City, Mich., has charge of the construction and is responsible for the design, and R. S. Conner, formerly associated with the Pittsburgh Testing Laboratory, will be chief chemist.

Arsenate of Lime

ARSENATE OF LIME is required by law in some localities to contain at least 40 per cent arsenic pentoxide substantially in the combined form. It should not contain in excess of 0.75 per cent water-soluble arsenic calculated as the pentoxide. The product must be powder of such bulk that one pound will occupy a space of from 80 to 100 cu. in. The commercial requirements are that the product should be relatively cheap and hence should be capable of manufacture on the large scale without the employment of skilled labor in undue amount. Generally a product is desired which is white in color in preference to products which are brownish in color or off color, although the intrinsic merit of the insecticide is generally not impaired by color variations, as these are not usually based on any chemical alteration.

Carleton Ellis and V. T. Stewart, of Montclair, N. J., have been able to meet these legal and commercial requirements by dry-slaking a high-calcium quicklime ground to 80-mesh, with arsenic acid preferably of 75 per cent strength. Arsenic acid of this concentration is a heavy viscous liquid of about 1.88 specific gravity. It provides sufficient water for such measure of hydration as permits the most advantageous contact of lime and acid, and is in a form convenient to handle and store. Variation from this strength of acid will be determined by the calcium-content of the quicklime used, that strength of acid being the most desirable that with its gradual addition, with suitable mechanical agitation, to the pulverized quicklime there may be no agglomeration of the mass.

With high-calcium lime in a finely ground state and arsenic acid of 75 per cent strength the reaction is so violent that the mass of quicklime becomes a seething, boiling body which acts more like a liquid than a solid in view of the buoyant effect of the steam disengaged during the reaction. This condition affords a bulky product corresponding very favorably in legal bulk requirement to products made by the more expensive method of wet precipitation.

Five parts of weight of quicklime of the quality stated treated with approximately six parts by weight of 75 per cent arsenic acid yielded a white bulky powder which analyzed 42 per cent of arsenic pentoxide and 0.22 per cent of water-soluble arsenic calculated as pentoxide.

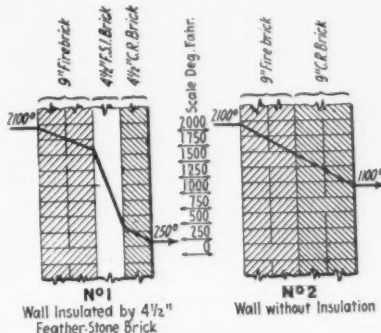
If additions of other substances are re-

quired they may be introduced into the lime of the acid or into the finished product, as may be most suitable. Thus, dextrine to afford better adhesion, calcium stearate to make the product somewhat less affected by water and other organic or mineral substances according to any special requirement.

—Iron Age.

Thermolith Cement

ANEW fire cement has been developed by the Harbison-Walker Refractories Co., Pittsburgh, Pa. The trade name given it is Thermolith. It is claimed for this cement that it sets hard and bonds fireclay brick



Cross-section sketches and graph showing heat loss through insulated and uninsulated walls

firmly without heat. Fireclay and many other fire cements are incapable of bonding firebrick at ordinary temperatures. Thermolith remains a bond at all working temperatures—extreme heat conditions neither fuse it nor crumble it. It is a high-temperature cement and a low-temperature cement. It is also claimed for this cement that it does not flux the brick at any working temperature, because it is chemically neutral. This same quality also enables it to resist the action of slags and clinkers, no matter whether acid or basic. It is mechanically strong. It withstands abrasion, either of furnace charge or mechanical equipment.

Thermal tests which have been conducted show this cement unfused at even the highest working temperatures, and in abrasive tests it has been impervious to sand blasts of sufficient force to wear down fire-clay brick. It comes in dry powdered form and is applied with a trowel after simple mixture with water. It does not require covering with water to prevent deterioration when not in use after the package is opened. It is packed in 200-lb. air-tight metal drums.

The cement is recommended by its manufacturers for use in cement, lime and pottery kilns, and for other uses.

Lime and Cement Manufacturers Waste Millions of Tons of This

FOR the purpose of classifying, investigating and extending the uses of carbon dioxide, particularly liquid carbon dioxide, the Liquid Carbon Dioxide Division of the Compressed Gas Manufacturers Association has established an individual Fellowship at the Mellon Institute, Pittsburgh, Pa., C. L. Jones being the incumbent. Data of unusual interest have been accumulated. Mr. Jones is now according research attention to the use of liquid carbon dioxide in extinguishing mine and electrical fires.

There are seven members in the Liquid Carbon Dioxide Division of the Compressed Gas Manufacturers Association. There are at least 800 cement and lime manufacturers who are throwing away into the atmosphere about 5,000,000 tons of carbon dioxide—CO₂ gas—every year. The day may come when it will be a valuable byproduct.

Bureau of Standards Tests Weathering of Limestone

ASERIES of tests to determine the resistance of limestone to frost action is now under way at the Bureau of Standards. Small samples cut from the stone are soaked in water and are then frozen. After freezing they are put back in the water to thaw.

Of the samples tested many showed serious disintegration after they had been frozen 75 times. Others have now been frozen 800 times and show as yet no serious disintegration. The samples come from different localities; and when the tests are completed the data will be of value to architects in the selection of building stone.

Limestone is now used extensively as a facing stone. It is less expensive than granite and more easily cut, which makes it quite popular. It is not so durable as granite, however, and is apt to show surface weathering within 100 years.

Other tests being undertaken at the bureau have to do with waterproofing compounds.

Ohio Lime Men Instruct and Entertain Building Officials

National Conference of City Building Officials at Toledo, Ohio

AS a part of National Conference of City Building Officials at Toledo, Ohio, April 24 to April 27, one entire session was devoted to papers and discussions on the manufacture and use of lime; and one entire day was devoted to an excursion to nearby lime plants. In addition, the National Lime Association, as host, provided a luncheon at Woodville and a banquet and evening's entertainment long



Fred W. Lumis, secretary, and Rudolph P. Miller, president, of the Building Officials' Conference, inspecting plant of the Woodville Lime Products Co.

to be remembered.

J. J. Urschel, president of the Woodville Lime Products Co., presided on behalf of the National Lime Association, which was officially represented by W. R. Phillips, general manager; G. B. Arthur, manager of the Central district; T. B. Shertzer, engineer, Eastern district, and Major Beyers, engineer of the Southeastern district.

Major Beyers ably explained the "Aims



Group of lime and building officials at Woodville Lime Products Co. plant



Plant of the Woodville Lime Products Co., Woodville, Ohio, from a point near the crusher house



Quarry and primary crusher at the plant of the Woodville Lime Products Co.



Building officials climbing "the Great White Way" in Woodville quarry

and Objects of the National Lime Association." Mr. Shertzer gave an illustrated lecture on "The Proper Use of Lime in Building Construction and the Legal Requirements Governing the Same." "Sand-Lime Brick" was the subject of an address by Warren E. Emley, of the U. S. Bureau of Standards.

Over 100 building officials of the larger cities throughout all parts of the country were present at the various sessions of the convention. Important steps were taken in the standardization and simplification of building codes, and their interpretation by building inspectors. A great deal of the discussion had to do with fireproof and fire-resisting construction and their definitions.

The Toledo meeting was the ninth annual convention of the Building Officials' Conference. President Rudolph P. Miller, of New York City, was re-elected, and Fred



W. R. Phillips and J. J. Urschel, "hosts extraordinary" of the building officials' conference



Party at the plant of the Ohio Hydrate and Supply Co., Woodville

W. Lumis, of Springfield, Mass., was re-elected secretary.

The all-day excursion to Ohio lime plants included the Ohio Hydrate and Supply Co., and the Woodville Lime Products Co. at Woodville, and the White Rock plant of the Kelley Island Lime and Transport Co. A visit was also made to the manufacturing plant in Toledo of the Valve-Bag Co. of America.

Besides Mr. Urschel, G. J. Whelan, vice-president and general manager, of the Kelley Island Lime and Transport Co.; E. G. Baker, president, and Frederick Witmer, treasurer, of the Ohio Hydrate and Supply Co., and President Hartman, of the Valve-Bag Co. of America, acted as hosts. A very enjoyable lunch was provided by the ladies of Woodville and a banquet at the Hotel Secor in the evening.

Pennsylvania Needs Five Times the Present Amount of Lime

THE value of lime as a vital factor in the production of farm crops has been recognized for many years. This is especially true in our Eastern states where American agriculture dates back to colonial days. For perhaps a century the farmers of southeastern Pennsylvania have appreciated the importance of lime and to this fact is due in large measure the prosperity of this great agricultural section.

As early as 1881, the Pennsylvania Agricultural Experiment Station recognized the importance of lime for soil improvement

and established at that time a series of lime and fertilizer field experiments, the results of which have paved the way for the scientific study of this important phase of agricultural research.

As this pioneer work broadened into more comprehensive fields and laboratory studies, it became evident that there is no one soil condition more prevalent in the humid region and none that has a greater controlling influence on the growth of crop-producing plants than soil acidity. We now know that practically all of our Eastern soils are in

need of lime. Figures gathered by the writer show that over 9,000,000 acres of Pennsylvania farm land are acid and should be limed for the best development of all farm crops.

The beneficial results evident from the use of lime have largely been derived through the use of amounts far in excess of that necessary to meet the immediate soil needs. This liming practice has especially been the case in southwestern Pennsylvania and throughout the great limestone valley sections of the state. Recent soil studies show that relatively small applications applied once or twice each rotation is much more economical than heavy applications applied at longer intervals.

The farmers of Pennsylvania are using annually less than one-fifth of the lime that is actually needed and could be used at a profit. The extensive grazing lands over the state kept in permanent pasture and at one time famed for the excellent blue grass sod are fast becoming depleted, with the result that the economic pasture grasses are being replaced by less desirable acid resistant weeds. The great dairy sections must face at once this serious problem of rejuvenating these grazing lands by liberal top dressings of lime and mineral fertilizer.

The response of Pennsylvania soils to lime and the profit derived from its use are fully emphasized by the results of the various lime experiments now located on four of the most important soils of the state. As an example the pasture grasses in Bradford county have been increased from a total of 462 lb. per acre in three years where manure was used alone to 6032 lb. with lime and manure. As investment of \$5 or \$6 per rotation or an annual outlay of less than \$2 per acre will insure a clover crop provided the soil is fertilized or manured.

On this basis an application of 800-1000 lb. of hydrated lime or 1100-1500 lb. of lime carbonate per rotation represents the safest and most profitable investment that a farmer is privileged to make.—*Pennsylvania Farmer.*

Hints and Helps for Superintendents

Removing Cinders Mechanically

THE old adage about Necessity being the mother of invention is once more proven by D. B. Simons, superintendent of the Southern States Portland Cement Co., Rockmart, Ga., for he has shown Rock Products editors many little kinks that are the results of his original ideas. Among



The carriage and track are 300 ft. long at an incline of approximately 25 deg.

other time-savers around his plant is an apparatus for removing cinders from the power house.

It is easy to imagine the quantity of cinders taken daily from a power house having six 400-hp. boilers. Some operations, where a like amount of cinders is handled, have elevator and conveyor equipment, while others have gravity and water disposal sys-

tems. Some continue in the old way by removing by hand, using wheelbarrows from the boiler room to the pile outside.

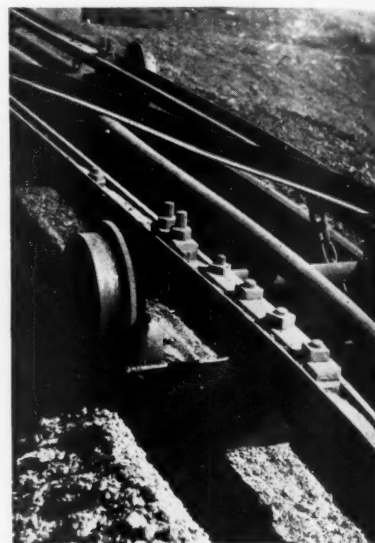
The latter method was used at the Southern States' plant for several years until, as Mr. Simons says, "the idea of our new system presented itself." The three illustrations show what "presented itself." The system comprises primarily of a 30-in. track of standard rail approximately 300 ft. long, a 12-in. by 9-ft. cylinder with piston and a carriage upon which the cylinder is mounted.

The carriage is the full length of the track, and its frame is made up of rails on either side, tied together by 1¼-in. angle iron. This frame is mounted on small wheels which once served on equipment in the cement mill. From this frame are suspended by chains ½x10x30-in. scrapers, which are spaced approximately 7 ft. apart and drag over a steel-plate bottom.

One of the illustrations shows the cylinder mounted on this carriage. The piston is bolted to a 10x10-in. timber, secured to the building. The steam line extends 10 ft. out of the building, 10 ft. above the ground and parallel to the cylinder. A second 10-ft. length of pipe, connected by a flexible joint, extends from the pipe from the power house to the cylinder. When the steam is applied the usual action of a steam cylinder is reversed. Instead of the cylinder being stationary and the piston moving, the piston remains stationary and the cylinder moves, thus causing the entire carriage to move. As the piston has an 8-ft. stroke, the cylinder and carriage travel the same distance. When it has moved 8 ft., an extended lever

from a rotary valve on the cylinder comes in contact with a block mounted on the track, thus reversing the motion. After traveling 8 ft. in the opposite direction the throttle comes in contact with a block on the other end, again reversing it.

Every time the cylinder goes forward 8 ft. each suspended scraper drags a quantity of cinders up the "track." When the cylinder goes backward, each scraper drags backward over the pile dragged by the one be-



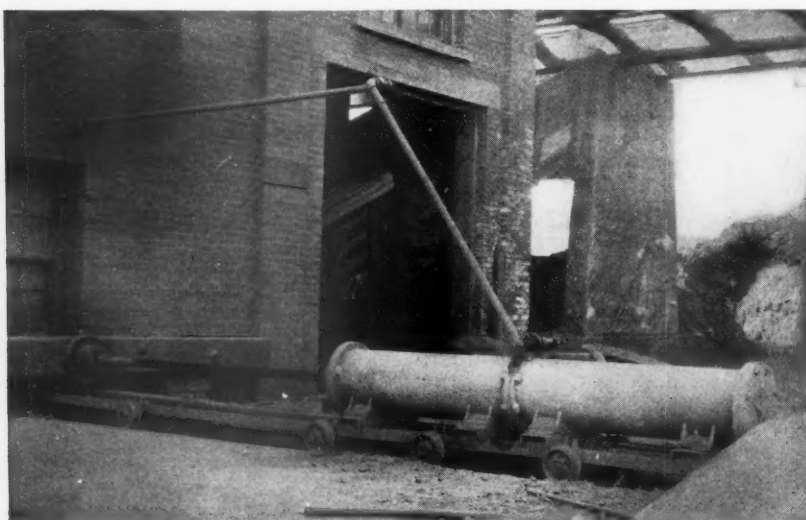
A close-up of a section of the carriage showing one of the chain-suspended scrapers

hind it and by the time the cylinder has moved back 8 ft. the scrapers pick up the pile followed by the one following it. Thus it can be seen that the system is entirely mechanical. Cinders are removed from the discharge end of the carriage by water.

Boiler Cleaning Schedule

WHILE boilers are not made up of small or delicate parts, nevertheless they require close attention, for without it they endanger human lives, and become an item of expense in a maintenance way. That is why owners are required by law to have regular inspections made. When an inspector examines a boiler he has certain recommendations to make to the operator; if they are not complied with the insurance policy becomes void.

The only regular attention a boiler requires is washing out. If all firemen could have this fact drilled into them, a large percentage of the major repairs made each year would be substantially reduced. Most



With the piston made fast to the building, the cylinder is forced to move, thus causing the entire carriage of scrapers to move

operators demand that regular washouts be made, but few know whether their demand is fulfilled. The few that do know have a systematic way of handling it.

The Dixie Portland Cement Co. at its

eration, while not unique, employs unusual methods.

Note the machine which is equipped with a clamshell. This railway type shovel, originally designed for pit duty, is serving sat-

Standard dipper equipment originally furnished on machines was found to be unsatisfactory because the teeth were not long enough and did not have the proper pitch.

Digging slag is unlike the digging of any

BOILER CLEANING SCHEDULE																		MONTH _____ YEAR _____													
Pay of Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Boiler No.1																															
Boiler No.10																															
Boiler	Cut in	Due to be Cut Out		Cut Out	Number of Days on		Why Taken off	Washed	Turbined	Remarks																					
1																															
2																															
10																															

By drawing up a cleaning schedule on the first of the month and adhering to it, boiler maintenance costs can be kept low

Richard City, Tenn., plant employs a method which assures those who are responsible for the economical operation of the plant that all the boilers on the entire job are receiving proper attention. Herewith is a reproduced sheet which the company uses as a cleaning schedule. Each sheet represents a month on which a record is kept of the work done on each of the 10 boilers.

When a boiler is washed out it is natural that gaskets be replaced, staybolts inspected and broken gratebars noted or replaced. With this sort of regular treatment, an inspector's recommendations are negligible.

Railway Shovel Used as Stationary Unit

HEREWITH is illustrated one of the washing and screening plants operated by the J. Fred Smith Co., Inc., near Dallas, Texas. It is easy to recognize that the op-

isfactorily as a stationary unit. The material is dumped on the ground within reach of the bucket and dumped direct into the hopper above the screens. Its operators claim that, from a maintenance standpoint, this method is much less expensive than the usual conveyor or elevator installations.

In addition to serving as a feeder for the plant, this machine furnishes steam to a two-drum hoist, used for spotting cars on both sides of the plant. Gravel is loaded from one side and sand from the other. This hoist does a lot of car switching that would otherwise have to be done by the locomotive. The plant's capacity is 18 cars per day.

Special Dipper Teeth

IT took many years of experimenting to finally perfect a design of steam-shovel dipper most applicable to digging slag.

other material. A bank of slag is loose, or porous, enough to dig without shooting, which is likewise true of a gravel bank. But by no means does a slag pit offer the "easy digging" of the gravel pit. It was



This type of teeth has been found to give most satisfactory service at the Birmingham Slag Co.'s plant. They are removed and sharpened daily



Novel clamshell installation. This machine once served as a pit steam shovel. Note the settling tank over the track

found that it must be dug with a dipper fitted with long and slender teeth set at an angle that would permit them to stay in the bank to the top. With a shovel having standard dipper equipment working in a 16-ft. bank this was not possible.

The illustration shows the type of teeth used by the Birmingham Slag Co. at its Ensley plant near Birmingham, Ala. The dipper is provided with a special front and the long, spike-like teeth are held in place without rivets or bolts. Several sets are kept on hand and a fresh set put in daily. A special tempering process is used in sharpening them so that their life is unusually long. To remove the teeth, a blow on the side of each of them with a sledge hammer loosens them sufficiently to permit a man to take them out with one hand.

Alloy Steels for Cement Mills

WITH industry in full swing again, steel for new machinery and repair parts is in demand. In such fields as the manufacture of portland cement, where the repair bill is unusually heavy and production has been at an uncommonly high rate for some time, the requirements amount to a considerable total. Specifications for replacements more and more frequently call for the higher grade, more durable materials, with a marked tendency toward the use of high strength special steel for the many parts subject to shock and vibration.

The chain that links up the various industries of the country sometimes dips down almost out of sight, but still it is there. For example, few would immediately see the connection between an unusually high portland cement production and a shift in demand by the mills of that industry to the special steels—not of sufficient volume materially to affect the market, of course, yet a noticeable trend.

Cement Plants Buying Special Steels

Demand for cement has always been largely seasonal, and in former years many of the mills shut down entirely during part of the winter for a thorough overhauling. Worn parts were replaced, and new equipment installed. Even at other times except during the summer peak, a short shutdown for repairs was not such a serious matter. But with the increased construction activity of recent months, and the growing practice of continuing building operations throughout the winter, demand has been carried into what was the slack season, and shutdowns at any time become of more consequence. As a result, the cement plants are turning to the more durable although more costly special steels that will last in service probably several times as long as the ordinary grades.

The flights in screw conveyors are a good illustration of this method of avoiding lost time. Usually the material employed for this purpose is low carbon commercial sheet steel, which is comparatively soft and wears rapidly when handling abrasive material such as cement. Through the use of a steel containing about 0.40 per cent carbon and perhaps 3.5 per cent nickel, hardened by rapid cooling, a much longer life can be secured.

Another instance is found in the case of the swinging hammers in the type of mill sometimes utilized in pulverizing the raw materials and the cement clinker, which is hard enough to scratch glass. Two sets of hammers made from tool steel having a scleroscope hardness ranging irregularly from 40 to 75 lasted for about 10,000 and 12,000 tons of rock each, and then had to be replaced. But when the same grade of tool was properly treated, thereby raising its scleroscope hardness to between 80 and 90.

the life of the hammers was increased to three times as long as formerly, for these second sets gave outputs of 32,000 and 36,000 tons respectively.

A third example also relates to screw conveyors. Lubrication of the shaft bearings of these conveyors is extremely difficult, and wear is correspondingly rapid. Chilled iron gudgeons were used for a long time with results thought fairly satisfactory. Then an installation of case hardened steel gudgeons was made in direct comparison with the older type, with the result that the steel bearings outwore six sets of those made of chilled iron.

Repairs to cement mill machinery are unusually heavy because of the nature and the number of the crushing and grinding operations to be performed. First, the rock and other raw materials must be reduced to powder, then coal for burning in the rotary kilns must be pulverized, and finally the resulting clinker must be very finely ground to make cement.

Requirements for Repair Material Large

With production last year some 14 per cent over any previous year, and output for the first two months of this year much beyond the rate of 1922, requirements for repair material will continue large. Extra parts for practically every piece of machinery must be kept in stock to avoid long delays in case of breakdown. The country's mills are already equipped to turn out a considerably greater supply of cement than last year's record output, simply by longer periods of capacity production. But equipment replacements and repair parts must be bought in proportion to the scale of operations.—*The Iron Age*.

Universal Cement Co. Buys 300 New Cars

IT was announced on April 24 that the Universal Portland Cement Co. would in a few days receive the 300 fifty-ton all-steel cars purchased some time ago from the American Car and Foundry Co. built at its St. Louis shops.

The cars will be used for shipments from the Buffington plant to points throughout the entire Chicago switching district. The new equipment will have much to do with preventing a shortage of cement during the coming season of hard road building and other construction activities requiring the use of that commodity in large volume.

It is explained that by use of the Outer Belt and other trackage facilities it will be possible to make shipments direct by rail to most points within a radius of 100 miles, and to a considerable extent relieve the necessity of long-distance hauls by truck.

Cement Man a Director of Rotary International

ROTARY INTERNATIONAL will be represented at its district conference at Beaumont, Texas, by Ralph E. Bristol, of Ogden, Utah, as a member of the directorate.

He was born in St. Louis, Mo., April 24, 1881. His father, Charles H. Bristol, is a native of Ithaca, N. Y. He attended grammar school in St. Louis and three years at high school in Chicago. He entered the construction department of the Western Union Telegraph Co. at 18 and worked in overhead, underground and submarine construction departments until he was 25.

Mr. Bristol married Florence Day, daughter of Chapin A. Day, partner of Marshall Field & Co. He left the service of the



Ralph E. Bristol

telegraph company three years later, moving to Utah to take up the management of the Ogden Portland Cement Co., of Ogden, and has resided in that city ever since.

At present he is the head of a number of corporations engaged in the manufacture of cement. He is also interested in coal mining, copper mining, and retail lumber.

During the war he was captain of the American Protective League for Utah and director of the Intermountain division of the Red Cross.

He is a charter member of the Ogden, Utah, Rotary Club and was first president of the organization, 1918-19.

"I am proud of the opportunity to serve Rotary International this year as a member of the board," writes Mr. Bristol to *Rock Products*. "I have just finished a trip of about 75 days, covering some 15,000 miles all told, where I have been representing Rotary International at district conferences, including the conference of Cuban Rotarians at Santiago de Cuba."

William L. Urschel in California Lime Project

WILLIAM L. URSCHER, brother of J. J. Urschel and formerly associated with him in the Woodville Lime Products Co., Toledo, Ohio, is reported to be the leading spirit in a new lime manufacturing project, 19 miles north of San Bernardino, Calif., near Camp Cajon. The new enterprise is the Cajon Lime Products Co.

More than \$200,000 will be invested in the first development unit, backed by Eastern capitalists. William L. Urschel of Toledo, Ohio, is president of the corporation, and with him are associated E. Bricker and W. F. Farmer, former residents of Baltimore.

The corporation has been working in preliminary development for two years. It was only recently that it was able to acquire full rights to 400 acres one mile west of Camp Cajon in Cajon Pass and near the Santa Fe and Union Pacific transcontinental lines. The company will manufacture four products—lime, hydrated lime, plaster and stucco. An analysis shows that the deposit contains 97.8 per cent pure limestone. Approximately 150 men will be employed in operating the properties.

Corporation offices will be maintained in Los Angeles.

Michigan Cement Company Prosperous

PROSPERITY has favored the Peerless Portland Cement Co., Union City, Mich., in that it has announced a 50 per cent stock dividend and also a cash dividend of 10 per cent. This was decided upon at a recent meeting of the stockholders, during which the company increased its capital stock from \$500,000 to \$850,000. W. M. Hatch was re-elected president and J. D. Gillespie vice-president. J. H. Panzer is the secretary-treasurer.

It is also announced that the company has made tentative plans for additions to its plant, as the company is working day and night and the present plant is overtaxed.

Alleged Cement Shortage in South Carolina

AN apparent cement shortage faces South Carolina and the situation will become more acute within the next few weeks, according to Charles H. Moorefield, state highway engineer. He bases his statement upon letters from large cement manufacturers and his personal observations. The highway department is making every effort to secure the cement for the program now under way.

An English firm has approached the department in the interests of bidding on cement sales, stated Mr. Moorefield; "in fact, foreign firms are becoming more in-

terested in the American market, due in part to the low freight rates by water."

Vauclain Sees Big Business Ahead

"BUSINESS will continue to prosper if Congress doesn't hamper the railroads by strangulation legislation," declared Samuel M. Vauclain, president of the Baldwin Locomotive Works, on his return from a tour of 22 states in the South and West. He found that the present prosperity throughout the country was not a "wave,"



Samuel M. Vauclain, President, the Baldwin Locomotive Works

but a general realization by the people that the business is here and that they had determined to keep it going.

Speaking to the subject, "The Public Interest in the Railroads," during the National Crushed Stone Association's convention last January, as related in ROCK PRODUCTS for March 10, President Markham of the Illinois Central System made a strong plea for the support of the rock products industry. President Finley of the Northwestern Railway—which owns quarries in nearly all the states through which it runs—also urged the support of the members in working for a better understanding between the industries and the railroads.

Both Markham and Finley stressed President Vauclain's point of non-interference to the end that the rock products industry, together with all others depending on the carriers for transportation, might get satisfactory service, unimpeded by those politicians who seek to further their own political ambitions through appeal to undeserved prejudice against the railroads.

A Big Bill for a Small Sum

WHAT appears to be a sort of record-breaker, when the length of the bill of complaint and the minuteness of the claim are considered, was filed in the United States district court for the eastern district of South Carolina recently.

The Southern railway is suing the Van Smith Building Material Co. for \$33 demurrage. The complaint takes up 19 pages and the amount claimed is \$33! The railroad has no release in the matter for the I. C. C. rules that transportation rules and laws must be carried out and there is no alternative. No matter who wins, the district will be kept busy trying the case.

Pennsylvania Agstone Group to Meet May 7

A MEETING of agstone producers and distributors in Pennsylvania has been called for May 7, at the William Penn Hotel, Pittsburgh, by Chairman Reinhold of the Pennsylvania Group.

Chairman Reinhold has the promise of Messrs. Harmon and Bayard of the *National Stockman and Farmer* to express their judgment as to how the use and sale of agstone can best be promoted. U. S. Senator David A. Reed is also expected to address the meeting. Members are urged to bring their county agents. The Michigan Limestone Co. is the latest contributor to guarantee \$300 for Pennsylvania advertising.

Fire Destroys Good Roads Machinery Storehouse

A HEAVY loss by fire was suffered by the Good Roads Machinery Co., Kennett Square, Pa., last week, through the destruction of its storehouse, which was full of finished equipment. This will not affect the company's production in any way, as the fire was almost wholly confined to the storehouse. Plans are under way to rebuild immediately.

The Good Roads Machinery Co. assures its customers that they will be amply taken care of.

Breaks 100,000 Tons of Limestone with 19 Tons of Dynamite

RECENTLY the Old Dominion Co. exploded a large blast at its quarry near Globe, Ariz., which will provide flux for its smelter for many months to come. A 60-ft. tunnel was driven from the face of the quarry ending at a point 112 ft. below the surface.

A charge of 19 tons of dynamite—one carload—was placed at the opening. The estimate is that between 70,000 and 100,000 tons of limestone were broken.

Rock Products Industry Loses an Old Friend

THE announcement of the death of Oscar A. White, advertising manager of the Fate-Root-Heath Co., causes profound sorrow to his many friends in the industry, and particularly to his close associates in the company. His death occurred at Plymouth, Ohio, on April 22.

President Root writes *Rock Products* that "Mr. White was more than an associate—he was a true and loyal friend. We feel that our life is better and richer for having known and worked with him."

Mr. White had a host of friends in our field. Many will recall his remarkable address before the National Crushed Stone Association convention held in Chicago a year ago. In addition to his literary attainments Mr. White was renowned as an orator of exceptional ability.

He was born at Salamonia, Jay county, Ind., on November 21, 1860. He was graduated from Lebanon College, Ohio in 1879 and afterward became principal of the Ridgeville (Ind.) High School for several years. In 1879 he married Anna Anders, who with one daughter survive him. He studied law and was admitted to the Indiana Bar in 1893.

Newspaper work always appealed to him and at different times he was the owner or editor of publications at Ridgeville, Ind., Mt. Gilead, Ohio, Greenfield, Ohio, and Plymouth, Ohio. From 1908 to 1912 he was the Chicago manager of the American Press Association. In 1920 he became advertising manager for the Fate-Root-Heath Co., Plymouth, Ohio, which position he held until the time of his death.

He was a member of the Methodist Church, active in all community affairs and was beloved by all who knew him for his unimpeachable character, wise counsel and staunch friendship.

George K. Burgess the New Bureau of Standards Director

WHEN Secretary Hoover selected George K. Burgess to succeed Doctor Stratton as director of the Bureau of Standards, general satisfaction was expressed by the engineering fraternity. Mr. Burgess is possessed of the highest qualifications for this important office—the most important in the government service.

Aside from understanding the many problems and planning broad investigations that will shed light on manufacturing difficulties, the director must be a leader of men whose life work is scientific research of the utmost accuracy; and an able administrator of the affairs of a series of great laboratories having a budget of \$1,750,000 annually.

He has been with the bureau for the past 20 years, and 10 years directing the Metallurgical Division. He was born in Newton,

Mass., on January 4, 1874. He got his S. B. from the Massachusetts Institute of Technology in 1896, his D. Sc. in Paris, 1901, taught physics until 1903, and then entered government service. His contributions to scientific literature are too numerous to mention. The Bureau has published several of his important monographs and papers.

Canadian Government Asked to Aid Asbestos Corporation Against Strikers

THE president of the Asbestos Corp. of Canada, W. G. Ross, appealed on April 26 to Attorney-General Taschereau for protection against strikers at the company's pits at Thetford Mines, after the office was attacked, 40 constables driven out of town, and threats made to dynamite public buildings and mine structures. General Manager C. H. McNutt was driven out of town twice by the strikers and sympathizers. Quiet was restored when the armed detectives were removed. The government was asked for aid in the event of a recurrence of violence.

Labor Saving in Quarries

H. E. BAIR, general manager of the France Stone Co., Toledo, Ohio, recently informed *Rock Products* representatives that if the caterpillar traction type of shovel proved as good as present indications, that within five years his company will have converted all their railway type shovels. The labor saving in the new type is unquestionable.

Mr. Blair also said that all his plants are now equipped with cranes for handling ground storage material and that the company stocked all sizes. This permits 11 months of operation per year instead of 8 months, and stabilizes the labor situation just so much. The extra cost of stocking has been found to be more than compensated for by the lower cost of a greater output and the regularity of operation.

The demand for stone this season, he said, is fair, but not so great as early indications would make it appear. Mr. Bair does not anticipate labor shortage at the plants, having now got them on a year-round manufacturing basis. He thinks the limiting factor in production this year will be the ability of users of crushed stone and other construction materials to get labor to carry on their work. He does anticipate a car shortage but thinks if the government keeps its hands off, the railways will be able to handle the situation. Most of the improvements to the plants being made this year, other than those mentioned, have to do with increasing their screening capacities and screening efficiencies. There is a noticeable movement to tighten up aggregate specifications and there is an increasing demand for the smaller sizes of stone.

Sues Contractor for Non-Acceptance

BREACH of contract is alleged by the McGrath Sand and Gravel Co., Lincoln, Ill., in a suit for \$40,000 filed recently in the Sangamon county circuit court against the Baker, Ageter & Thompson Construction Co. of Indianapolis.

The defendants hold the contract for building the hard road east of Springfield through Riverton. The McGrath company charges that the defendants refuse to carry out a contract entered into last October, although the plaintiffs stand ready to deliver the material. It is said that the contractors were able to get a lower price and sought to take advantage of it.

The Egyptian Gravel Co., of Olive Branch, Ill., has brought suit against New Madrid county for \$100,000, alleging breach of contract. The case was tried before Federal Judge Farris in St. Louis last week, and taken under advisement, the attorneys for both sides being directed to submit briefs when the case is to be argued.

Meeting of Illinois Sand and Gravel Producers

THE Illinois Sand and Gravel Producers' Association held a conference at the Halliday hotel, Cairo, Ill., on April 12, discussing matters pertaining to the industry, and then visited the plant of the Halliday Sand Co. in the Ohio river.

The visitors, who were entertained by H. H. Halliday, included: M. D. Schaff, president, of Springfield; E. Guy Sutton, Danville; W. C. Roberts, Chester; Mr. Morganoor and Mr. Brymer, Clinton, Ind.; W. T. Murphy, Paducah, Ky.; R. C. Yeoman, Indianapolis, Ind.; Ben Stone, Indianapolis, Ind.; J. C. Aldous, Alton, Ill.; John Cantalon, Mattoon, Ill.; T. E. McGrath, Lincoln; John Brandt, Lincoln, and C. A. Homer, St. Louis, Mo.

Confiscation of Coal Declared Illegal

ROCK products manufacturers who suffered inconvenience and loss last year because of the loss of coal purchased and consigned to them will be interested in a recent decision. The Alabama Supreme court, though Chief Justice Anderson, decides against the legality in an action brought by a consignee of coal taken by the Southern railroad for its use. The court says: "If such a custom could govern the shipment of coal, it could be established so as to extend to other goods and commodities, and it would be contrary to public policy to recognize a custom which would permit carriers to convert to their own use articles they had contracted to deliver by, in effect, stepping into the shoes of the consignee."

Enterprising Producer Shows 'Em How to Maintain a Gravel Road

GUY C. BAKER, vice-president of the Greenville Gravel Co., Greenville, Ohio, writes:

"Have you kept pace with the rapid development of the intensive road maintenance and full-time patrol idea throughout Ohio, Indiana and Michigan?"

"Having its incipency in Michigan, the idea rapidly was carried south into Indiana and during the past year has made wonderful progress in Ohio. In order to demonstrate to the officials of our own county the results that could be attained by full-time patrol, the Greenville Gravel Co. took over the maintenance of seven miles of one of the principal highways in this county and at our own expense graded and drained the roadway and began the maintenance of the road full-time with washed material as the aggregate. We expect to continue this for five or six years at our own expense.

"The result of the first year's maintenance was so striking that not only did our county officials take up the idea for Darke county but the officials of other counties in western Ohio made pilgrimages to Darke county to see the road, and as a result the idea is going like wild-fire through Ohio.

"Mr. Coppock (president of our company), who has made a very thorough study of the subject, has written a paper covering gravel road maintenance, believing that inasmuch as the idea was here, that gravel men should awake to the fact and anticipate it by educating officials to the idea that the success of road maintenance depended not only on the character of the work but the character of the material.

"Our company is having a large number of these pamphlets containing the article printed for distribution. They will not be sent out for a couple of weeks."

Coppock's Arguments

Among other things, Mr. Coppock writes in his article:

We have, by reason of the nature of our business, made an exhaustive and careful study of the subject of road maintenance under these new conditions. We operate a number of large gravel washing, screening and crushing plants in four different states, and are vitally interested in the continued and proper use of gravel as a road material. Our interest, therefore, would seem as an obviously selfish interest, depending as it does upon the successful use of properly prepared gravel for road construction and maintenance, and yet this article is prompted by a sincere desire to help solve in a practical way a vexing problem irrespective of personal interest.

The common fault with the old method of road repair is that after the materials have been placed on the road they are left as deposited for the traffic to pack and as traffic follows only the packed wheel tracks, this creates ruts which in wet weather will hold water until it soaks away. This water softens the material on the road and also the sub-grade so that traffic mashes the gravel down, mixing it with the dirt below, causing

chuck holes and ruining the road. It is necessary to prevent ruts or depressions which hold water, and this can only be done by dragging often, and by the proper use and kind of surface materials.

Most of the old gravel roads have been built from gravel found in local deposits, and while they do not as a rule need rebuilding, they do need a different kind of maintenance. Most of these roads have sufficient material on them so that if the proper drainage was provided and proper forming of the road's surface had, very little repair material would be needed to keep them in good condition. The success of gravel road maintenance depends more on the proper drainage and dragging than on the amount of material used.

For maintaining the average gravel road the material should be that of a very fine clean gravel without sand. A washed and screened pebble ranging in size from 1/10 to 3/4 in. has proven satisfactory; preferably a pebble from 1/10 to 3/4 in. Never use larger than 3/4 in. pebbles. This should be applied in very thin layers as required. Each application should be a little more than enough to absorb all the worn-out particles or mud and soil on the surface of the road. There should at all times be a loose thin coating of this material on the road surface. The dragging of the road will move this loose material back and forth, filling in the low places as they occur and keeping the road smooth at all times.

The reason why a fine gravel is better than coarser material for a road dressing or surface use is that if larger particles are used the process of dragging will pull the larger stones loose from the surface, making it rough and impossible to keep smooth.

An application of 1 in. of fine gravel twice during a season will keep a much used gravel road in excellent condition. This would require 400 cu. yd. of material per mile. The average gravel road could be well maintained with one application per season or 200 cu. yd. of material per mile. The roads which are used very little would require still less.

As to the cost of proper maintenance. The side ditches of the average gravel road can be cleaned out so as to provide good drainage at a cost of approximately \$250 per mile. The other costs vary materially, depending on the amount of traffic. If the traffic is heavy, the material and labor costs would amount to from \$600 to \$800 per mile per year. If the traffic is medium, this cost would be about \$400 per year. The by-roads or gravel roads which are used very little could be maintained in good condition at a cost of \$100 or less per year.

Toronto Cement Corp. Takes Over Ontario Cement Co.

THE Toronto Cement Corp., Ltd., has been incorporated at \$3,000,000 and has taken over the buildings, machinery, properties and assets of the Ontario Cement Co., Ltd., of Brantford, Ont. The officers are A. J. Young, president; Col. J. Z. Fraser, vice-president; A. M. Harley, secretary; H. C. Shields, chief engineer, and George McRea, resident engineer.

The new corporation will complete the work started by the Ontario company on its property at Beachville. All the build-

ings are planned for an ultimate capacity of 4500 bbl. per day, and plans are now being completed for the installation of the first unit of 1500 bbl.

One 11x200-ft. rotary kiln will be installed. The new kiln building, fuel mill and cement stack house are practically completed. In addition, a new raw material storage building is being planned, 570 ft. long and 80 ft. wide, together with raw and clinker grinding building, blacksmith shop, machine shop, oil house and store house. The coal, gypsum, clinker, limestone and clay will be housed in the new storage building and served by two high-speed, 15-ton, electrically operated overhead cranes.

An analysis of the clay and limestone is as follows:

LIMESTONE	
	Per cent
Lime (CaO)	54.73
Insoluble matter	0.56
Iron and alumina	0.30
Magnesia (MgO)	0.50
Loss by ignition CO ₂ , etc.	43.28
Undetermined sulphates, etc.	0.63
	100.00
CLAY	
Silica (by fusion)	47.56
Alumina	12.99
Oxide of iron (Fe ₂ O ₃)	4.57
Lime (CaO)	12.20
Magnesia (MgO)	3.01
Carbon dioxide (CO ₂)	11.09
Sulphuric anhydride	0.14
Loss by ignition, organic	5.56
Undertermine alkalies, manganese, etc.	2.88
	100.00

Taking the average analysis, the limestone and clay, says Engineer Shields, first-class cement may be made by using the materials in the proportions of 2 1/2 of limestone to 1 of clay, making a cement of about the following analysis:

	Per cent
Lime	63.80
Silica	23.41
Alumina and iron	7.86
Magnesia	3.48
Alkalies, etc.	1.45
	100.00

The estimated manufacturing costs and earnings are set forth as follows:

MANUFACTURING COSTS (OVERHEAD)	
	Per bbl.
Main office, salaries	\$0.04
Main office, rent, telephone, light, etc. ....	.01
Selling .....	.10
Taxes, local plant—say .....	.01
Insurance, local and casualty—say .....	.01
	—\$0.17
MANUFACTURING COSTS (MILL)	
Superintendence and labor	\$0.24
Power, based on \$27 per hp. per year or 3/4 cent per k.w.h. ....	.08
Kiln-coal, based on 100 lb. of coal burned per barrel, clinker-burned .....	.28
Quarry (no labor included) .....	.05
Oil and waste .....	.01
Repairs, material only .....	.05
Gypsum .....	.01
Depreciation, say .....	.05
Packing and shipping, say .....	.06
	— .83
Total cost per barrel, net mill	\$1.00
MANUFACTURING COSTS AND PROFITS	
Selling price of 500,000 bbl. (output of first unit) net, mill, at \$2	\$1,000,000
Interest on depreciation and reserve funds	31,000
Total gross income yearly	\$1,031,000
To manufacture 500,000 bbl. of cement at \$1 per barrel	500,000
Expenses during winter shut-down	25,000
Total annual expenses	525,000
Total net annual earnings from first unit	\$ 506,000

What J. L. Shiely Is Doing

Spreading the Gospel of Cleaned and Screened Aggregates

"A SAND and gravel or crushed rock plant is, broadly, a combination of individual ideas, local practice, market requirements, theory, engineering, common sense—and some errors," declared J. L. Shiely, president of the J. L. Shiely Co., St. Paul, Minn., and chairman of the 19th district of the National Sand and Gravel Association, in a recent address before the Engineers Club of Minneapolis in connection with the showing of his educational film. Incidentally, we wish to say that Mr. Shiely has given his lifetime to intensive study of his industry, its purpose, its possibilities, and its responsibilities. And he wants the public to know just how important is his product to its welfare and its comfort.

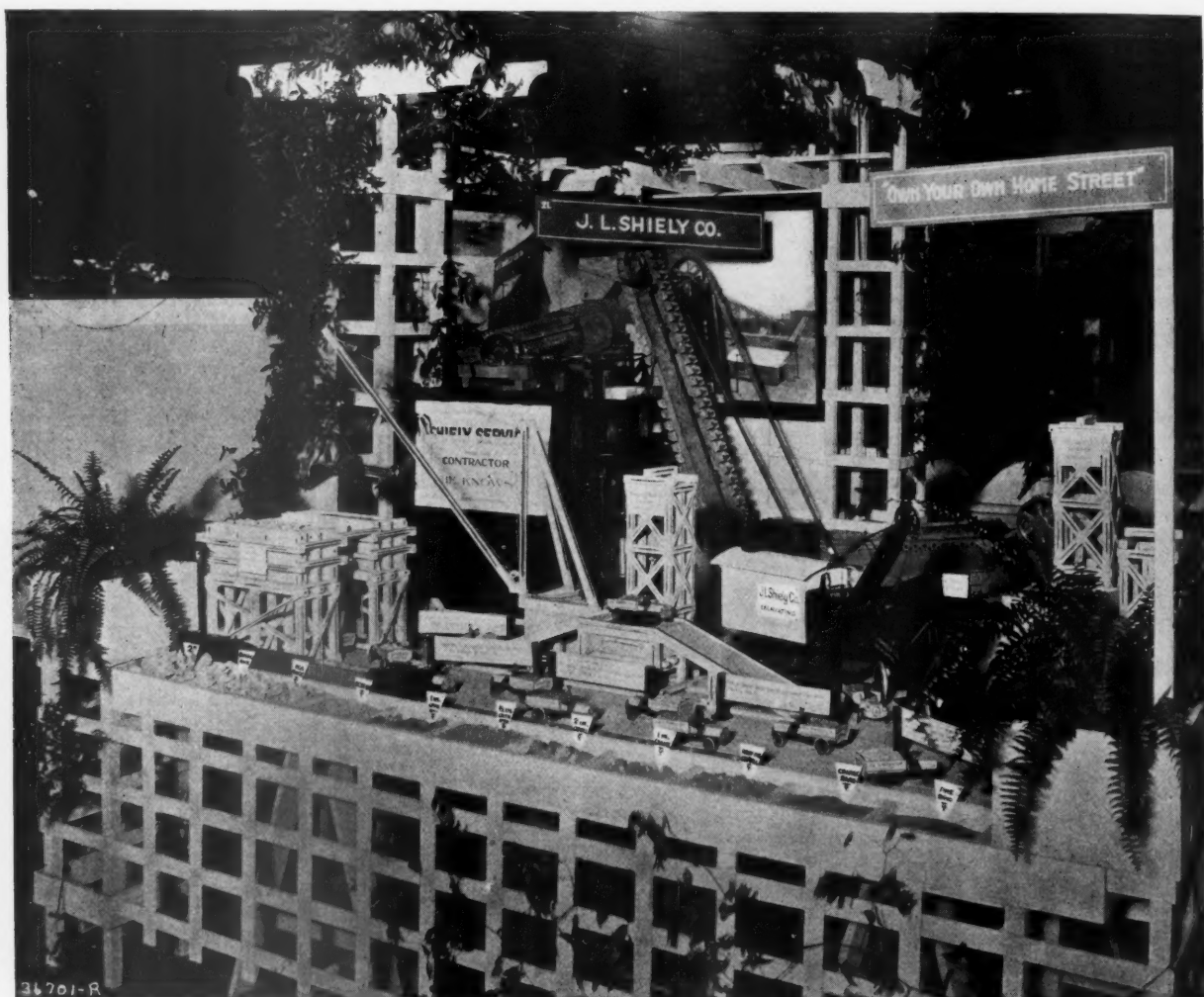
"The idea we wish to convey tonight," he said, "is that we are making an honest endeavor to give the user of concrete or masonry materials a quality product—all that is good in that connection, and trying to show that which is good.

"Aggregates are not suitable for concrete unless they contain the solidity and strength you expect of them. Notice your curb, sidewalks, driveways, foundations, and even your paving; while there has been a saving, there is a corresponding loss in quality. The cost of first-class aggregates compared with a good job and an indifferent one is insignificant. Some material can be used if handled intelligently by a competent engineer; in actual practice it's left to a laborer whose only recommendation is a strong back

and a weak mind. Don't use such material.

"Our message to you tonight is one of endeavor to enlist your co-operation to the end that the public will know that engineering advice is needed to accomplish good results when material is not of recognized standard. We believe that errors have been almost eliminated by the producers, but until the engineers specify and see that the contractors use these well-graded, clean materials, there will be errors in favor of the producer and a corresponding lack of demand for your services. Again we emphasize: Not how good, but how cheap."

Attention is called to the illustration on this page as reflecting his activity in putting before the public the importance of sand and gravel in the building industry. Here is a plant in operation, with all its attendant equipment, showing the intelligence and care necessary to produce high quality material, and how it is all done. This exhibit was shown during the Minneapolis Building Show, and reflects great credit on Mr. Shiely for enterprise in spreading the gospel of cleaned and screened aggregate.



The J. L. Shiely Co.'s remarkable exhibit at the Minneapolis Building Show

Accident Prevention

Canada Cement Co.'s Plan for Safety

LESS than two years ago, the management of the plant of the Canada Cement Co. at Port Colborne, Ont., began a campaign for the prevention of accidents. An account by the assistant superintendent of the measures adopted appeared in the *Canadian Manufacturer* for October.

After various schemes were tried without success, a plan was finally worked out, which is claimed to have very materially reduced the number of accidents. An analysis of the causes of the accidents which had recently occurred there showed that only a few could have been prevented by guards, and that the campaign would have to be very largely educational. A suggestion box was installed, and four men were detailed to make guards and do other similar work.

The plant was thoroughly inspected and the dangerous places were noted and rectified. It was found, however, that little progress in accident prevention was being made, as the interest of the men had not been aroused. The plant was then divided into sections, each foreman to have a committee of his own and to act as chairman.

It was decided to hold a combined safety meeting every week to be attended by all the committees, each foreman to be at liberty to call a meeting of his own committee at any time. To add interest to the weekly meetings each foreman was asked to visit some other department than his own, and to report on the conditions as to cleanliness and safety.

These reports were handed to the assistant superintendent and presented by him to the meetings with the names of the foremen reporting omitted. In the most conspicuous places safety bulletins were posted up, some of these bulletins being supplied by the National Safety Council and some being original ones devised in the plant. The plant is divided into departments, and when a department is free of accidents for a month the head receives a star.

When there is no accident for three months he receives one red star, and if six months pass without an accident he receives two red stars, and so on. A penalty system was also introduced whereby each department is penalized for accidents according to the numbers of men, the hazards, etc.

The success of the campaign is attributed to the means adopted to keep the employees interested and to arouse their

enthusiasm. In addition to the great improvement of the accident record, it was also claimed that the production of the plant had increased.

its employees, with the caption "Unadulterated Carelessness." It is signed by Everett F. Libby, safety director.

UNADULTERATED CARELESSNESS

What the Man Did

1. He removed used boards from fastening, leaving protruding nails in them.
2. He made a standing place with the boards, placing them so that points of nails pointed upward.
3. He stepped on one of the nails, pushing it into his foot about an inch; then he went home without reporting the injury and applied a piece of salt pork to the wound.

What He Should Have Done

1. The nails should have been removed before the boards were put to any use.
2. The boards should have been placed with nail points down; at least, he could have bent the nails over.
3. He should have immediately reported the injury to the foreman, so that first-aid treatment could have been had, and the case promptly attended to by the company doctor or some other physician.

When the injury was finally reported and a physician called, infection had set in. This could have been avoided if a physician had been called at the time of injury, and this is what should have been done.

The injury occurred in January. The man has been laid up ever since. A foreman saw the man remove and carry away the boards with the nails in them, and said nothing. Would you believe a thing like that could happen anywhere around this plant, after all the energy and money that have been expended trying to educate the employees to be careful? But it did happen, and happened in this plant.

It is the duty of every foreman to see that nails are removed from all old lumber or material lying around.

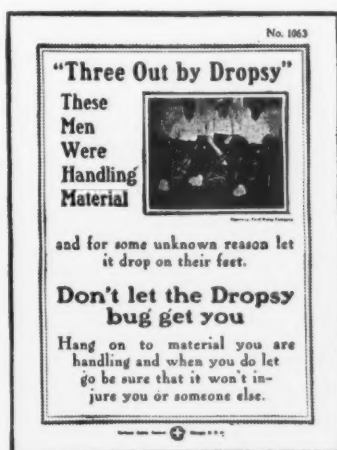
It is the duty of every employee to see that nails or boards with nails in them, are not left around the plant and under foot.

Dr. Foss, our company doctor, informs the writer that a wound caused by a nail puncture is a very dangerous thing, and unless properly treated is very apt to result in lockjaw or blood poisoning. And that all nail punctures should be treated by a physician as soon as possible.

THE U. S. BUREAU OF MINES at the request of the Wisconsin Industrial Commission, gave a first-aid demonstration recently in half a dozen cities of that state for quarry and gravel workers. Two hundred and eight quarrymen were given a similar demonstration during 1922.

36 New Safety Bulletins Each Month

Will Make Your Shop Bulletin Board As Interesting As a Newspaper



All posters are attractively printed in two colors. Sizes 9x12 in. and 17x23 in. Members of the National Safety Council receive 36 different safety posters each month—extra copies as desired. A new bulletin every day.

OUR SAFETY BULLETINS attract the workers' attention and hold their interest. No highbrow stuff—they don't shoot over the heads of the workmen! Simple, yet full of human interest, they put the safety message across in a way that sticks! Results? They have helped many of the Council's members to reduce accidents 75 per cent or more because they instruct, they stimulate safety thinking, and they develop the safety habit among the men.

SAFETY BULLETINS comprise only one item of the service you will secure through membership in the National Safety Council—a non-profit co-operative association of 3,500 employers helping each other to reduce the cost of accidents to their workers.

Write for sample safety bulletins today—post them on your bulletin boards and watch the results.

National Safety Council

Co-operative Not-for-profit
168 North Michigan Avenue CHICAGO

Good Work of the Rockland Lime Corp.

IN its company bulletin for February 6, the Rockland and Rockport Lime Corp., Rockland, Maine, has the following to offer

Book Review

BELT CONVEYORS AND BELT ELEVATORS. By Frederic V. Hetzel, member Am. Soc. M. E. and member Franklin Institute; 33 pp., 6x9, 291 illustrations. Cloth; \$5 post-paid. John Wiley & Sons, New York.

Reviewed by Edmund Shaw

THIS is one of the most valuable books for the mineral aggregate and similar industries that has appeared in recent years. The author is thoroughly competent to write it, since he has been designing and building conveyors for 30 years, which is about three-fourths of the time that they have been in extensive use in the United States. And although he has been connected with one of the largest manufacturers of elevating and conveying machinery for 13 years, the reader will have difficulty in determining which one from the book, as the illustrations and examples have been taken from the products of all the large makers of such machines.

Most of us who buy elevators and conveyors rely on the manufacturer's judgment as to the particular type and size required, and this is wise, as such manufacturers are responsible people, and their experience and knowledge of such machines are greater than that of any individual user.

But manufacturers are human, and it is their business to sell as well as make machinery, and they will often sell a customer a machine that is only indifferently adapted to his work because they have no choice between doing this and losing the order altogether. The fault is really the customer's because, in his ignorance of the matter, he thinks that the manufacturer is trying to load up the order with a lot of unnecessary refinements, when really all that the manufacturer is trying to do is to supply him with a machine that will fully satisfy him.

This explains why such a book is of great value to the operating man. He can check up both his own limited experience and the manufacturer's specifications, and be sure that he is getting just what he needs. It is evident that the author had something like this in mind when he wrote the book, for on page 115 he gives the steps to be taken to design a belt conveyor, or to check up a design, in just this way.

Not the least interesting part of the book is a history of belt conveyors. It surprises one to learn how much thought and experimentation have gone into the development of such a comparatively simple machine. We have come a long way from the first belt conveyor that was dragged along in a trough so that

more energy was expended in wearing out the belt than in conveying the material. It took years to perfect the troughing idler. Some forms pinched the belt and others split it, while others caused the plies to separate. It is only in quite recent years that best forms of troughing idlers, conforming to the natural curve of the belt, have been developed.

The book is too long to abstract sufficiently to give a full idea of its contents, but the reviewer cannot find that anything of importance has been omitted. There are 43 pages on belts for conveyors, not only rubber belts, but those of canvas and balata, and the little-used steel and wire fabric belts. Idlers are given 30 pages, none too much for such an important subject. The matters which principally affect belt operation—speed, capacity, loading, discharge, etc.—are given 70 pages, and there are abundant tables and diagrams, not only to explain but to aid in the design of conveyors. Especial attention is given discharge and loading arrangements.

There is an exceptionally good discussion of the life of belts, with a list of the factors that make a belt short-lived. Some of us who have looked on the rubber belt as the one and only conveyor belt, will be surprised to know of the excellent records made by other kinds, such as stitched canvas, which has given extraordinary records in handling sand and gravel. The author might have pointed out even more forcibly than he does that more belts are destroyed by injuries and by deterioration to the weather than by actual wear in service, for this is unfortunately true.

One is glad to find a chapter on the differences between belts and other conveyors, and the reasons why other forms are preferable in some cases.

The second section of the book, on belt elevators, will be even more useful to the operating man, as there are more elevators than conveyors in use, and it is not uncommon for an elevator to be designed and built at the plant. The author has been very thorough in his discussion of elevators.

An interesting chapter is that on elevator speeds, a matter about which there will never cease to be discussion, as is shown in the examples taken from practice in the book. Mr. Hetzel finds the proper speed by an algebraic formula, and the table of speeds which he obtains in this way seems to conform to the best practice. There has been a tendency on the part of plant designers to run ele-

vators at too high speeds in the effort to get a clean discharge by increasing the centrifugal force.

An entire chapter is given to the fastening of the buckets to the belt, and it is not too much. In this chapter there is a table of the standard punchings for the various types and sizes of buckets in common use. The causes of buckets working loose and protecting devices for preventing damage to the belt are clearly explained, and the author does well to point out the value of inspection. In properly run plants, all elevators are regularly inspected and all loose bolts tightened, and there is little elevator trouble until the belt begins to wear.

The work done by the pick-up of an elevator is rarely calculated by the man who is building his own elevator, and the effects of belt slip and creep are not understood by him. The book has a good explanation of these things. The lagging of the head pulley is advocated as a means of preventing traction, and simple rules are given for finding the required horse-power.

The boot, which in some ways is the most important detail of an elevator, is shown in several forms, and there is an explanation, which one is glad to find, of why the bucket must pick up at least part of its load above the level of the foot shaft if it is to work to capacity. Some of the forms of automatic take-up shown may be new to the rock products industries. The special shapes of foot pulleys, designed to prevent stones from lodging between the belt and the pulley, do not seem to meet with the author's approval.

Not the least valuable chapter of the book is that which treats of inclined elevators. There is a rule for laying out the sag of the belt on the return side of such an elevator that will often be useful, as this is an important matter where the buckets have to pass the edge of a bin on the return. If space enough is not allowed, the buckets will catch; and if one plays safe and allows too much room, the elevator is made longer than it need be. The conditions of discharge which necessitate an inclined elevator are explained and there is a good discussion of the advantages of the inclined over the vertical form.

The book is well written, and while the illustrations are not over-abundant, there are enough to explain the text. One might wish to see some added chapters on chain elevators and their operation. There is a call for a book which would discuss these and the other forms of conveyors than belt conveyors in the same thorough and comprehensive manner that the belt machines have been treated in this.

Slate Quarrymen's Association of Growing Importance

Only a Year Old—Has Already Done Much
National Advertising and Specification Work

By Alan B. Sanger

New York Representative of Rock Products

CONGRATULATIONS are due the officers and members of the National Slate Association for the large attendance and enthusiastic meeting held at the Hotel Commodore, New York City, on April 20. Its success was largely due to the unceasing activities of the association's officers who, during the past year, have studied very thoroughly many of the problems of vital interest to the slate producer and fabricator.

Several important points were brought up by the more progressive members. Through their insistence upon threshing each point out, many ideas were obtained, and from this composite an efficient working program will undoubtedly arise.

To summarize the subjects taken up:

1. Electrical slate industry.
2. Relations between the quarryman and the fabricator.
3. Standardization of products.
4. Relations between slate producer and "roofers."
5. Question of sales-policies.
6. Credits.
7. Co-operation between blackboard producers and the "crayon" manufacturer.
8. Advertising and other publicity.
9. Traffic.
10. Labor.
11. Secretary's report.

Unquestionably, the subject of sales policies was the keynote of the meeting. While this point was not brought up until well into the morning session, it was reached by logical steps, and when the time came the matter was covered by N. M. Male, Jackson-Bangor Slate Co., Penn Argyl, Pa., and cover it he did. His very frank talk and driving arguments will undoubtedly cause the more conservative members to come into the fold and spur the active men on to further beneficial results. More of this later.

Electrical Slate Industry

The meeting was opened with George F. Barnard, Monson Maine Co., Boston, Mass., in temporary charge. Part of the morning session was given over to those interested in "electrical slate." Secretary Hays brought out the fact that the apparent prejudice against slate for electrical purposes was due

to its thinness and to faulty installation rather than to any inherent inferiority in the slate itself. Investigation has shown that in some of the old battleships the slate panneling, after being used for many years, was found to be in perfect condition in spite of the rather severe treatment accorded it.

Another of the troubles has been the cus-

operation these troubles may be eradicated.

Dr. Oliver Bowles, of the U. S. Bureau of Mines, brought to the attention of the meeting his paper on the slate industry which is to be read on June 29 at the annual convention of the American Society for Testing Materials.

His paper is to include four general uses—structural, electrical, roofing, and blackboards—but at this time he took up only the electrical phase. The most important point to be considered is "dielectric strength." Such things as moisture, mineral content, cracks, stringers, etc., affect the desired property adversely. Mr. Smith, North Bangor Slate Co., pointed out that carbonaceous matter was more detrimental than mineral oxides, causing leakage.

It was Dr. Bowles' purpose to get the various ideas on this subject and embody them in his paper. He suggested that the slate quarrymen co-operate with the Bureau of Standards. All slate men are cordially invited to attend the A. S. T. M. meeting at Atlantic City.

Relations Between the Quarry Man and Fabricator

At this point Mr. Brown took the floor and told of some of his experiences gained on a trip through the Middle West. He had been in touch with some of the fabricators and for their benefit aired their grievances. This group claim that they do not get protection from the quarryman; they being large consumers of raw slate, should get better prices and service than every Tom, Dick and Harry who wants to purchase a small lot. Another point was that the quarryman is very slow in his shipments, thus forcing the fabricator to turn to substitutes; this is especially irritating when the user receives a shipment damaged through faulty crating and then has to wait a long time for the replacement to come through. Substitute salesmen are more active in their solicitation and have thus raised a barrier against the slate industry.

In answer to this, the quarrymen say they cannot stock ahead because of a lack of standardization, each job being a separate affair and starting practically at the quarry. Another claim is that substitute salesmen



W. S. Hays, Secretary, the National Slate Association

tomary peaks and depressions in the orders. It seems that users of electrical slate come into the market suddenly for large quantities and expect immediate delivery or orders will be canceled or shipment postponed; one case being cited where goods were thrown back on the shipper and not called for for two years. Such treatment has made the slate man feel that he is the "goat." Unquestionably, there is some basis for this feeling, and it is hoped that through co-

exaggerate conditions at the quarry and that they cut prices right and left.

Standardization

Mr. Brown's discussion led up to the question of standardization, which was sponsored by C. H. Davis, Davis Slate and Mfg. Co., Chicago. Although in the slate business only 10 years, Mr. Davis has made radical changes in the production and selling of slate. He firmly believes that slate products can be standardized and thus benefit all three—quarryman, fabricator, and consumer. It is his desire to establish a set of thicknesses and widths and have most of the purchasers adhere to that schedule and in this way make it possible for the quarryman and fabricator to do more stocking and to simplify production methods.

In line with his standardization ideas, he has developed better production ideas, especially in "planning." It is his contention that if a fabricator can reduce the "tolerance," the uses of slate would increase tremendously. He has succeeded in making a reduction from 1/32 to 10/1000 in, either way, a result which will prove very beneficial, according to an engineer of the Western Electric Co., who wrote, "Uniform slate with 10/1000 plus or minus would help the slate industry tremendously. Panels now give far too great an error and cause a rejection. The final consumer of electrical slate insists upon as near duplication as possible."

Relations Between Slate Producer and Roofers

Following Mr. Davis, Edwin L. Seabrook, representing the National Association of Sheet Metal Contractors, gave an interesting talk; and while he hit the slate producers hard at times, there was ground for such action and unquestionably good will come of it. Mr. Seabrook championed the "roofers," who claim unjust treatment at the hands of the slate man.

In the distribution of slate-roofing products, there are three natural steps to be taken; if one of these steps is omitted, the natural sequence is up set and some man unjustly impoverished. The specific points brought out were:

1. Sale of slate direct to architect, contractor or owner.
2. Not allowing roofer a profit on the slate he handles.
3. Apparent inequalities in prices.

As a result of this alleged unfair treatment, the roofer is switching his influence to the lines which are better for him personally. Several prominent producers rose to the defense, claiming that they do not get fair treatment from the roofer. They have in many cases been unable to locate roofers to handle jobs; they have had these men buy slate from them on terms, sell the slate for less than it cost, and then go bankrupt; roofers have unduly influenced the possible purchaser and have turned the sale to a substitute.

Mr. Seabrook came right back, and after

upholding the producers in these individual cases, made several helpful suggestions which would make for a better feeling between the two groups. These were:

1. Quote prices to architects only for the purpose of enlightening the ultimate consumer.
2. To sell contractors direct only when they are big enough to have roofers on the payroll at all times.
3. To establish branch sales offices so that the consumer may have facts and figures at his immediate disposal.
4. Have all inquiries referred to local roofers.
5. To compile a list of roofers.



Dr. Oliver Bowles

6. To co-operate with the roofer in every way because he is the only man who confines his interest to slate. The builder and owner have many other points of interest and naturally slate must be of minor importance.

At the close, Mr. Seabrook suggested that the roofing-slate producers investigate the Florida market. He gave facts and figures on the competitors which would indicate that something of interest would be discovered.

Sales Policies

The discussion of Mr. Seabrook's subject led up to the most vital question of the day. This was very ably handled by Mr. Male; he did not mince matters but frankly stated his opinions and drove home his arguments in such a way as to make the most conservative member do some hard thinking. He summed up his arguments very succinctly in three questions:

1. Have we a sales policy?
2. Do we want one?
3. Will it be of benefit to us?

Elaborating on these questions, he admonished the members that now was the time to put the slate industry on its feet. "Make

the jobber a seller rather than a mere order taker." Until recently, the slate people have been more or less drifting; their selling methods, haphazard and quite individual in their trend; the creation of a market has been left to others not so vitally interested. He put it up to the slate people to get together and do something or else suffer a loss in market and popularity of their product.

Credits

Following lunch, the question of credits came up, and once more Mr. Male came to the fore and drove home the facts—disagreeable but true—that the slate people have been very backward in their credit programs. As was natural, cases were cited where roofers and jobbers had been actually dishonest in their relations with the producers. Offsetting this, Mr. Davis said he felt that the credit report was engendered by unhappy personal experiences. He has had practically no trouble with his accounts in his 10 years of business. To answer this it was brought out that the electrical trade was on a much higher plane than the roofing industry. Mr. Male then cited his experiences which forced him to come to the conclusion that a sound and uniform credit system was desirable.

Mr. Morrow, Rising & Nelson Slate Co., West Pawlet, Vt., put a motion that the association adopt some sort of insignia or stamp to the effect that this member belonged to the Credit Bureau of the National Slate Association. This stamp was to be placed on all invoices. This motion was seconded and unanimously passed. All details are to be left to Mr. Hays, as secretary, who is to conduct the bureau and make it a clearing-house for all ideas and information which can be gathered. Through this department it is hoped that healthier financial relations can be established between the producers and those who handle the product.

Co-operation Between Blackboard Producers and Crayon Manufacturers

Digressing somewhat from the association's activities, a few minutes were taken by Mr. Hard, vice-president of the American Crayon Co., to tell of that industry and how the two groups could co-operate to the welfare of both.

He frankly stated that the trouble with the use of blackboards is due more to the crayon than to the board. His company is not as yet satisfied that the perfect crayon has been produced, although the "Hygeia" dustless crayon is probably the best in the market. It is the custom of some manufacturers to put clay in as a filler. This causes the well-known "slipping"; also it has had a tendency to form chemical compounds with the soap used to clean the boards. As a result there has sprung up a prejudice against that form of teaching, so much so that in the last 10 years that trade has fallen off to about one-third its former status.

With the improved crayon and better methods of planing boards, it is believed that a decided gain can be enjoyed. At any

rate, the consensus of opinion among educational people is that blackboard work for scholars is the best way to teach them; with this as a basis, it should not be hard to place the trade in blackboard slates in a satisfactory position. Mr. Hard offered every co-operation in the endeavor to place the best before the school authorities.

Advertising

Conklin Mann, advertising expert, outlined the publicity plans of the association. At present, 12 publications are used, and the combined circulation of more than 300,000 monthly reaches the architectural, building, electrical, and trade fields. More papers are to be taken on when funds are available and at the present time considerable publicity is being prepared in the form of pamphlets and circulars to be distributed to the jobber and other producers. Some of the magazines are running editorial articles on the uses of slate, but the industry should not and cannot rely upon the editors to carry on the battle.

Mr. Mann put it up to the producers to back him to the limit and to send in pictures and data which refer to the uses of slate. He is especially desirous of getting photographs; they have been hard to get. That the publicity program was bearing fruit was shown by the far greater number of inquiries received at headquarters, fully five times as many coming now as compared with a year ago.

Traffic

Mr. Brown, who previously spoke on the relation between fabricators and quarrymen, handled the traffic problems in an effective way. He reported fair success in his dealings with the railroads. Such questions as embargoes, inequalities in tariffs, standardized "estimated" weights, and new side-track contracts are a few of the questions now being discussed with the various officials. He brought out the fact that the producer and fabricator should co-operate on "through" shipments in order to secure better rates. It might be well to mention the danger in the new side-track contracts which are being offered by the railroads. It seems that the signature of the quarryman makes him an employer of every man on the railroad while the latter is in the yards; thus he is liable for any injury which that man may receive. This danger should be of interest to every quarryman regardless of his product.

Labor

Not much time was devoted to labor, notwithstanding its importance, yet Mr. Smith reported some success in his individual dealings with the Pennsylvania legislature. He believes he will obtain favorable action on his petition to be allowed to use boys from 14 to 16 in the summers and from 16 to 18 at all times. Should he be successful, it will establish a precedent which will be of decided value to other quarrymen.

Secretary's Report

Mr. Hays reported very satisfactory prog-

ress both in membership and in interest. A year ago members numbered 17; now they number 40 active and 13 associate. Several firms have applied for membership and it is believed that before long a 100 per cent association can be reported.

The finances are in good shape, delinquent accounts small, and every dollar put to its fullest use. The business of the slate industry was better in 1922 than in any other year—\$9,000,000 sales reported. With the publicity planned and if every man gets behind and pushes, it is believed that steady progress will be reported at each succeeding convention.

The writer cannot close without adding a word or two regarding the remarks injected now and then by Mr. Shinville, Fair Haven Marble and Marbleized Slate Co., Fair Haven, Vt. As in all conventions, a good hearty laugh is an excellent tonic, so Mr. Shinville's wit supplying the necessary pep to a real good meeting.

Report of Better Production Methods Committee

THE Committee on Better Production Methods submits herewith a report of such matters as have been presented for the consideration of this committee.

Owing to the difficulty of obtaining a meeting of the committee prior to the date of the convention, the secretary, on February 27, requested each member of the committee to submit to the chairman, through the secretary, any suggestions or ideas on this subject which would seem to be desirable to have included on April 20. There have been several replies to this request, and from these replies your committee is of the opinion that by co-operation with the manufacturers of machinery, it is probable that improvements in methods of operating quarries and mills are possible.

The suggestion was made at the last convention that, in the matter of opening up quarries, the large amount of slate shattered by use of channeling machines may be materially reduced by using the broaching method of channeling, which has been used in other materials very successfully for many years, and is still in use; also, that there is a possibility of the development of the wire saw which has been in use for many years in the sawing of other rock products. The difficulties of installing the wire saw in the quarries are not insurmountable, and from the information now in the hands of your committee, it would seem to be easily overcome.

Suggestions have also been received looking to improved methods of sawing slate by the use of the diamond-tooth saw or the carborundum tooth saw. Experiments with these saws have not yet been carried along to the extent which would lead your committee to recommend the immediate installation of saws of this type, but your committee feels there is a possibility here that should not be neglected; that experiments should be continued, and that there is quite a possibility that machines of this type could be developed to the point where they would perform excellent work.

The subject of improved machinery for the finishing of slate is one which is well worthy of the combined thought of all manufacturers of slate products. The installation of small rubbing beds for small work,

carborundum machinery for resawing, rabbetting and molding have already been adopted by some manufacturers, who report excellent results.

While it may not be entirely within the province of this committee to discuss the labor situation, in the reports which have reached the committee that subject has been introduced, and it is the opinion of the committee that this situation could be much improved both to the benefit of the worker and the producer by making it possible to increase the number of working days which would allow the laborer to feel some certainty of working at his trade.

In some places roofing slate is being made by larger use of machinery than is the general practice of the producers of roofing slate. Sawing the slate instead of plugging it produces less waste, and if roofing slate were made in freezing weather in steam-heated sheds, the production could be made a matter of more continuous occupation for the worker and the manufacturer.

The larger use of machinery all along the line is the great need of the industry as a whole, and if the association members as a whole are willing to install improved machinery for all operations, there is no question but what machinery builders will take up the subject, and by experiment develop improved machinery not only for the quarry but for the mill. While some individuals have done considerable experimenting along this line, there does not seem to have been any concerted action to any definite end, and unless a substantial market can be assured builders of machinery, there is no inducement for them to go to the large expense necessary to develop and bring out improved machinery so necessary to the prosperity of the industry.

H. E. FLETCHER, Chairman.

Report of Uniform Records Committee

FROM a study of other associations, the Uniform Records Committee thought that progress in developing uniformity in cost records and other record keeping is made slowly, based on the actual needs of an industry and the consensus of opinion of its membership.

Record of Slate Sales by States

We recommend that all members of the association and other distributors and producers of slate begin keeping the record of shipments by states, and that G. F. Loughlin include in his blanks for slate in 1923, space for the report of slate sales by states and that such information be furnished the U. S. Geological Survey so that we may more intelligently plan our merchandising efforts and improve our freight-rate situation.

What Is Your Cost System Doing for You?

In reading up on this question, we want to quote certain things which the Chamber of Commerce of the United States has said which might be applicable to the slate industry.

"No one asks you today if you have an automobile, but the query is: What kind have you, and how is it behaving—so with cost systems.

"There are more kinds of cost systems than gas engines and their vagaries and non-performances are just as many—if you haven't the right kind."

A car that doesn't operate right costs a lot in repairs; a cost system that fails to show what it should, consumes profits.

It will pay to check out on your system as you would on your car; you ought to know the upkeep and if it pays.

Does your system do all of these things:

1. Give you up-to-date costs, not merely history?
2. Aid in stabilizing your wages and piecework rates?
3. Help you maintain a perpetual inventory?
4. Increase your production?
5. Measure your overhead?
6. Detect new overhead expense?
7. Point out leaks in expense?
8. Encourage your employees?
9. Promote intelligent competition?
10. Point to non-profit paying lines?
11. Permit you to bid safely?

Here is a testimonial of results from a prominent producer of steel products using an effective system:

"You ask the results (of the cost system installed) which we actually use.

"First, certain lines of products which we had previously pushed, thinking they were carrying a very fair profit, were discontinued entirely as we found they were being manufactured at a loss.

"Second, the actual costs of products manufactured on certain groups of heavy machines were found to be much in excess of the estimated cost. The selling price was increased materially and we were still able to sell at a very fair profit. The cost of certain products manufactured on lighter machines was found to be less than we estimated and we were able to sell the product of these machines at more nearly the market price.

"The net result was that the load was spread more evenly over all of our machines and light machines which had always been overloaded in the past were all operated at a more even and regular percentage of capacity."

Uniform Systems

Are you in one of the hundred or more lines using a uniform system? The printing line is one, and here's what a manufacturing printer says:

"It goes without saying that a knowledge of costs enables one to place a fair selling price on the product. The psychological value of actual knowledge of costs, furthermore, is to lend a tremendous power to the factor of salesmanship. With a consciousness of efficiency and economy in administration of business, it is of great consequence to be enabled to say to a customer or a prospective customer that a given estimated price is absolutely just because it is based on known cost figures.

"We would under no circumstances even think of running a printing business, or any other business in which we might be engaged, without the use of a cost system."

Some people may ask: "What is a uniform system?"

It is the setting up of a set of principles and an outline of plans adaptable to a given line of industry enabling, when desired, those in that industry to present a statement of unit costs which will be in every particular on a comparable basis with other producers using the same system.

Here is the testimony from the electrical industry:

"Generally speaking, it is our opinion, based on experience, that it (a uniform cost system) has strengthened the position of the electrical manufacturers in dealing with the government and with large customers in all contracts or reports in which costs were an essential feature.

That is to say, a cost based upon the standard practice of the industry inspires confidence as the soundness of the basis on which it is compiled."

The way is therefore clear for us to gradually develop a uniform cost system in the slate industry, but it must be built around our existing methods with the least inconvenience or change in our present systems. It is a matter that will take several years.

As a step in that direction, however, we would recommend that any member in the association who is considering the installation of any new record or method of accounting should write the committee through the secretary and obtain the benefit of any suggestions that we may have to offer or the experience of other members.

The same thing could apply to office equipment or any other service feature. If some member has experimented or tried out something and given it up because it was not applicable to our business, other members should not go to the same unnecessary expense without knowing of this experience.

Some of the broader questions which we might discuss at subsequent meetings of the association, by mail through our bulletin or in other ways, might be:

1. How should selling and administrative costs be recorded and the high cost of distribution reduced?
2. How should budgets be constructed and used?
3. Should inventories be valued at actual or replacement cost?
4. How may costs be used by management in formulating and carry out business policies?
5. Should prepaid freight receipts be treated simply as a cash advanced account and not be included in total slate sales?
6. Where one producer sells another of the association material in the rough, which member should pay the assessment to the association? The one who finishes and sells it to the trade or the one who produces it?

There are more similar problems.

C. W. BARKER, Chairman.

Report of Credit Service Recommendations Committee

A SLATE Credit Bureau would raise the standards of our industry and lessen our business costs and losses. Such a service nationally through the National Slate Association will be of value to the public and to the slate industry. Among some of the benefits are:

1. Reducing losses from unwise granting of credit.
2. Weeding out deadbeats.
3. Curbing undue inflation of credit.
4. Preventing pyramiding of losses among several members.

If such bureau is supported by all members of the association it can be made of great value—easily one of the most valuable items of service the association can render its members.

Knowing the losses of the slate industry due to lack of exchange of credit experience and after a study of credit information service of other associations and the legal phases involved, your committee feels the National Slate Association should undertake

service to its members along the informal lines herein discussed.

A very important feature of the credit system which may be developed later is the investigation of those who propose to become purchasers for the purpose of resale; or, in other words, slate contractors and dealers. A successful investigation in such an instance should include not only the mere question of credit but also the ability, willingness, and aptness of the proposing purchaser to carry on his business in such a manner as will not injure or reflect discredit upon the line of goods manufactured by the members of the association, where the improper use or installation of the slate sold lead to a general condemnation in the public mind of the use of such grade of goods. This class of investigation and report is often of more value to the entire trade than the mere financial investigation, and it would seem that information with respect to such matters would naturally and properly be made in connection with financial investigations. Of course, where a product stands by itself and will never be commended by reason of the improper use thereof, this would not be a factor. To illustrate: In the sale of edged tools for which a manufacturer attains a reputation for quality, there is nothing to take into consideration except quality and price. The fact that a hatchet made by A is not good does not condemn the use of all hatchets. But in the slate business perfectly good slate, improperly laid on, may result in condemnation of the use of slate in general.

It is a fact that some products for sale depend as much upon the proper use of them as upon their inherent quality, and the improper use destroys and militates against the entire business. Very much, therefore, may be done by our association through a proper credit bureau, or, more probably, investigation bureau, to promote the expansion of the business and increase the sales of the product.

Primarily, such credit information service will protect our members against persons who fail to pay their bills, or those who are preparing to fail after involving all the credit they can. Being neither arbitrary or coercive, but working to eliminate misunderstandings and establish better business methods, the association should also raise the credit standing of the whole industry. It should encourage prompt payment of accounts, thus reducing our expense of borrowing capital for operations and production because of delay in getting paid for slate sold.

Diplomatically and informally, the association may aid in collection of delinquent accounts. The strong moral effect of the group appeal upon delinquent debtors will often result in quick collection at little expense and the payment of many small accounts which would admit of usual collection charges.

Your committee recommends that the National Slate Association credit and collection service be started in an informal and inexpensive way by our present staff in Philadelphia. A few months' trial will enable us to work out a plan best suited to the needs of our members rather than to superimpose any costly elaborate systems on our present methods.

Therefore, we recommend that the association concern itself only with investigations and information on buyers against whom members may complain. Such information will be made available to other members only on request and in such coded reports as to protect the source of information.

As in other industries, we have a few

buyers who habitually engage in sharp practices. They take extra time for discounting their bills, exceed the net time of payment, pay by notes in lieu of trade acceptances, or make a practice of filing unjustified complaints. They claim unfair deductions for freight, unusual conditions veiled in their order, knowing the seller cannot afford to sue for such small sums. They reject shipments merely to force a lower price or cancel orders without cause.

Nor is your committee unmindful of the equal need of our association members and slate buyers for protection from unscrupulous sales policies of slate producers and distributors. Such practices we hope to remedy through enforcing the Code of Ethics adopted at the January meeting. We recommend that the secretary study all existing practices in the industry which may have a bearing on the credit situation. That, wherever possible, he endeavor informally to have the parties discontinue shady practices. Failing to secure favorable compliance, he shall endeavor to have formal complaints made to the association for action under the Code of Ethics. Such practices are deplored as skimping grades of slate or furnishing an inferior grade where order and specifications require another grade, unless formal acceptance of substitution by customer with corresponding reduction in price has been secured. Absorbing standard charges such as freight, cartage, tear, or breakage, or in any way camouflaging prices to make unfair competition are methods not in accordance with good business practices.

The members of this association are urged to stand behind the principles of our Code of Ethics and to compete for business only on the fair basis conducive to the best interest of all parties and the owners and public, our ultimate consumer.

A credit bureau within our industry compiling fresh confidential data as to the overdue obligations of the buyer, his pay habits, his business methods as shown by past transactions, etc., can be of infinitely greater value to the concern or member participating in such association service than data secured from any ordinary credit agency.

The following principles shall be adhered to in our credit service:

1. Association shall act solely as medium for exchange of experiences of its members. This means it shall merely compile and distribute facts reported to it as to responsibility or acts of delinquent parties or parties concerning whom any member may request information.

2. In reporting such data or replying to inquiries from members, the secretary's office shall make no recommendation, either expressed or implied, as to any action the members should take regarding parties concerning whom information is given; that is, the individual member must exercise his own judgment as to whether he should extend further or new credit to party about whom he secured credit information from association office.

3. As far as it is humanly possible, such information must be furnished by the association to its members in such a way as to make it unintelligible to others. This is to avoid even the possibility of libel suits against the association or members furnishing information.

4. The Association Credit Bureau must be conducted in a fair spirit. When one complaint is received from one member, other members, or whatever sources of information possible should be sounded as to give inquiring members as complete and fair a report on any party as possible.

This will avoid any chance of doing an injustice because of the first informant being prejudiced or acting with malice.

5. If, as a result of such investigation or knowledge of the case, the association secretary finds a bona fide misunderstanding is causing the delay in settlement of unpaid account, he shall use all reasonable means to clear up the questions involved, have account paid and restore credit standing of buyer. Failing to do so amicably and informally, the dispute, if both parties thereto agree, may be laid before the board of directors of the association for arbitration. The board of directors shall call into session with them an advisory committee of at least three men, representing the same line of business as the buyer. All decisions shall be made under the Code of Ethics of the slate industry and every reasonable effort made to settle disputes without loss to both sides in or-

der to place the credit standing of the slate industry on a high plane.

As soon after the first of May and each successive month as it can be learned, the members shall report their overdue accounts to the secretary. By proper codes, as suggested in page of forms herewith, they can indicate which accounts are risky and to be reported to other inquiring members. In no case will the association aid in the collection of a past due account except on special request from a member giving all facts and details of any misunderstood items.

In presenting this report and asking for its discharge, your committee urges that such service be authorized by a vote of the membership at the annual meeting. April 20.

N. M. MALE, *Chairman*,
A. H. MORROW,
C. A. LOWRY, *Committee*.

COLLECTION AND RATING FORMS

a. Members reporting to secretary each month list of overdue accounts will follow approximately the following form:

Report from Company No. Date.....1923.

Below is the name, business, and address of every customer with overdue accounts on our books. The rating checked applies except where we have made some special notes. All ratings are based on our ledger experience with the customer and not on an opinion of the customer's credit elsewhere.

NAME	BUSINESS	ADDRESS	Amount now overdue	Maximum credit ever given	Experience Rating Check letter indicat- ing your previous experience with party	Remarks

C R E D I T S

We hereby certify that none of the accounts listed above are or have been disputed; that there are no setoffs or counterclaims against any of such accounts; and we thereby agree to indemnify and save harmless the National Slate Association from any and all liability arising from the publication, circulation and distribution of said information.

Overdue accounts are those not paid within.....days, with our terms.

Signed by.....(Initials only)

b. Association in requesting rating from members to check rating on any buyer will use something like following form:

Confidential Report

INQUIRY SHEET
Credit Department

No.....

Cipher Rating Code	C — Pays cash, never asks credit.
	R — Pays exactly when due, discounting bills usually.
	E — Pays in 30 days or less.
	D — Usually takes 60 to 90 days.
	I — Considered slow, usually takes three to six months or more, risky account.
	T — Experience teaches to request cash.
S — Unfortunate circumstances (sickness, etc.), prevented satisfactory adjustment of account.	

Credit Allowance: Largest amount of credit extended at one time.

FULL NAME	ADDRESS	BUSINESS	Check the letter indicat- ing your experience with the party	Credit Allowance Amount	Amount New Credit
C R E D I T S \$ \$					

Very Important: We want only your *own* experience with the customer, actual ledger experience, free from personal feeling. Be *fair*, be *honest*, just as you would care to be judged.

All Business Pertaining to This { DO NOT SIGN YOUR NAME HERETO
Report Is Strictly Confidential

c. In reporting to members, the secretary will give review of reports received on any party using either the code rating above or some other without divulging in any way the source of his information other than to give how many members have reported on such party.

d. Unless required by the exigencies of the case, all exchange of information on credit and collections between the secretary's office and members shall be by mail. All members are urged to make return mail replies in order to expedite the system. In case telegraph or telephone inquiries are made for credit information requiring telephone or telegraphic answers by the association, such extraordinary services will be charged at cost to the members. In other words, all telephone or telegraph services on such matters will be sent by the secretary's office, collect.

Cost Accounting for Slate Quarry Operations*

Vital Importance of Knowing Costs and Selling for Not Less Than the Cost of Production

By W. H. Smith

North Bangor Slate Co., Bangor, Pa.

IT will not be denied that the safety of any line of business consists in the ability of that business to make a profit. This is axiomatic. When the profit is unobtainable in any business, the end of that business is at hand. The only way that a profit can be obtained in any business where goods are produced and sold is by knowing accurately what the cost is to produce the goods and by selling them at an advance over their cost, including the cost of selling. Hence, it is perhaps more important to have a system of accounting that will truly reveal the costs of the goods than any other element in the entire accounting system, for this is the foundation stone on which the entire business edifice is built.

We are speaking here as quarry men to quarry men and there is nothing to be gained by glossing anything over. So I want to state plain truths which, though in no way pleasing or flattering to ourselves, must be recognized as the truth before we can do better.

It is said that "Honesty is the best policy." I believe that this is true with respect to our dealings with our fellow-men, and especially with respect to our dealings with our competitors—that is, with respect to each other. But there is one other fellow with whom there is no doubt whatever as to the good policy of Honesty—and that fellow is myself. There is one fellow particularly that I don't want to fool—and that fellow is myself. Now, let us consider a few facts which show how some people have fooled themselves, and the result.

Cost-Finding Vital to Life of Slate Industry

In 1900 there were 104 concerns manufacturing slate in slate districts of the country. Some of these were in Georgia. Today, to the best of my belief, there is not a slate quarry operated in the state of Georgia. The concerns operating in the state of Georgia fooled themselves out of existence. The extinction of the slate industry there has not come about by reason of failure

of the supply of material or by any other perceptible cause except that they sold their goods below their actual costs, but probably above their supposed costs. I do not know



W. H. Smith of the North Bangor Slate Co., Bangor, Pa.

whether any slate men from Georgia are here, but we do not need to go so far as Georgia.

Last summer I was in the Peach Bottom district on the borderline of Pennsylvania and Maryland. The aspect of things in that formerly important section producing one of the highest grade roofing slates in the world is pitiful, and makes the heart of a slate man sick to behold it. Quarries filled with water, no development ahead, no place in any quarry where profitable production

is obtainable, and a hopeless credit condition.

The cause? Same as Georgia. Their product was sold above its supposed cost, but under its actual cost. Important elements of cost were glossed over or lost sight of altogether. Another case of the producer fooling himself.

But we don't need to go so far as the Peach Bottom district. I am from the Bangor district, in the very prolific Northampton and Lehigh county region. We have the same conditions there, but, I am thankful to say, in a less degree. Whether by reason of lower cost of operations, larger capital, better operating plans or better knowledge of costs, I am not prepared to say, but as a matter of fact, while our condition becomes very serious, it never at any time reached the vanishing point, and we are now making a substantial recovery.

These remarks are made preliminary to suggesting a remedy. Many of us have already applied the remedy. Many have not. That remedy is an accounting system that will include all the elements of cost and its reduction to the unit cost of a square of slate or a foot of mill stock or black-board.

Such a system is properly the work of a committee and cannot be presented intelligibly in a discussion here. I merely wish at this time to call attention to some items properly entering into the cost of slate, which have in the past been forgotten by many operators, some of whom may be with us, but many of whom have passed by.

Items Entering Into the Cost of Slate

One of these items is development of quarry. We all know that to make slate quarrying a successful business from year to year, the stripping and preparation of a quarry must go on pretty constantly, so that at no time will the available supply of good rock be exhausted, with no additional piece of rock ready.

At no time can an operator say to himself that the sum of his payroll and his bills is his cost for any month or year. He must never forget the money he has spent in stripping and preparing his piece of rock,

*Paper read at the Meeting of the National Slate Association, Hotel Commodore, New York City, January 22-23, 1923.

and that he will have to do the same thing again.

The prudent thing to do, therefore, is to religiously charge up or set aside a part of such expense and include it in his operating expense as a part of his operating cost. My own method is to carry on my books a "Development Account." To this account

I charge all labor and expense of every kind connected with stripping. I then estimate the life of the piece of rock stripped, and, in closing the books each year, charge off the fractional part of the cost which that year represents.

Another item is depletion. This the government income tax construes as the "ex-

haustion of the rock deposit." An allowance for depletion will be made by the income tax department to the owners of the property only. They will not make such an allowance under this name to the lessees of leased property. Depletion can be taken by the property owner and based on a price per square.



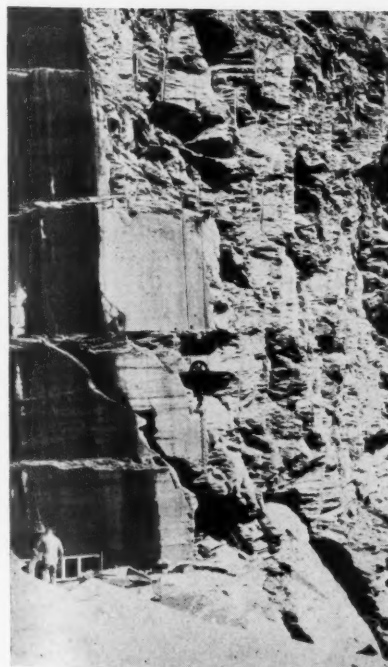
Revetting is sometimes employed to keep the quarry free from falling overburden



Some of the slate quarries go to great depths



Aerial carriers are essential in removing slabs of slate



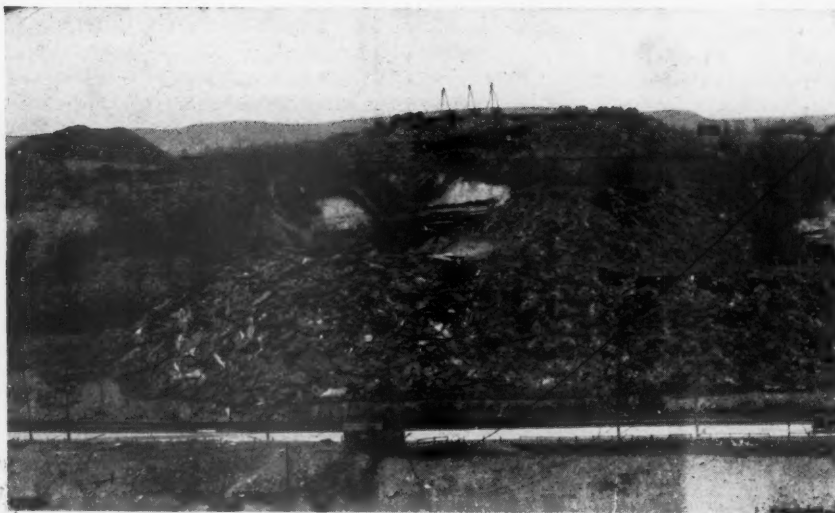
A contrast between the effect of blasting at the right and channeling at the left



Another case where retvetting was necessary



The steel A-frame shown here is unusual; wooden frames are more common



Tremendous waste piles are one of the slate industry's drawbacks



Cleaning the debris from an old quarry



Ready for orders—roofing slate piled in orderly rows at Mr. Smith's quarry



These masts and hoist are typical of a slate quarry



Slate quarrying is a careful job because shattering must be avoided



A slate quarry crew. Work is a



from an old quarry preparatory to working it again



and hoist hoist typical of a slate quarry



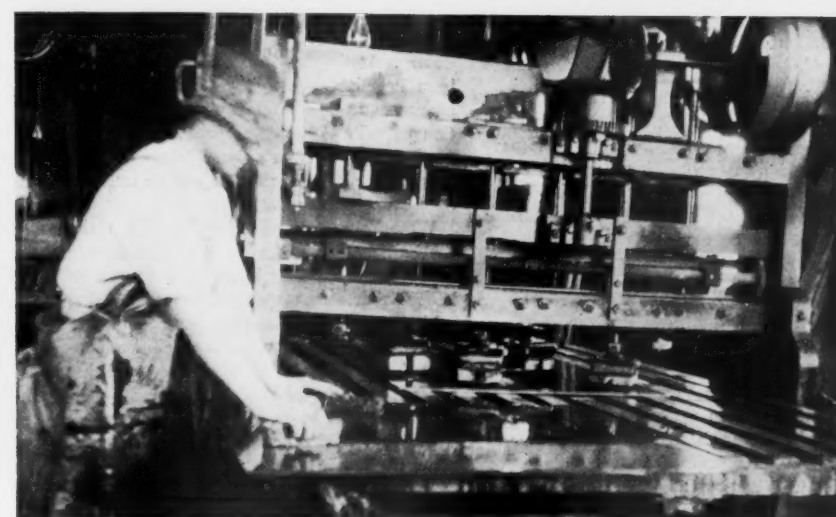
quarry crew. Man is standing at the left



In this mill structural slate and blackboard are sawed and polished



Channeling machines make the vertical side-wall cuts



Blackboard needs careful polishing. The four revolving arms produce a smooth surface

Another item that must not be overlooked is depreciation of machinery and buildings. My own method of charging depreciation on a leased property is to charge off yearly such a sum on a leased property as will leave only a scrap value for the buildings and machinery at the expiration of the lease. For operators owning their own properties an annual depreciation charge of 5 to 10 per cent would not be too large, but a uniform practice adopted by this association would be desirable.

Manufacturing Costs

In arriving at manufacturing costs a desirable unit of time to use for calculation is one year. In January, after the closing of the books, the average cost of production for the past year should be made up. This is comparatively simple in the case of a quarry making only one article, as roofing slate. A division of the number of squares of slate made into the entire expenses of the year, not forgetting development, depletion and depreciation, will give the cost per square accurately. The important thing is to do it. No slate operator should make prices for a new year without knowing exactly what his cost was for the past year.

For properties making a number of lines, as blackboards, mill-stock and roofing slate, the process of separating the costs and charging the various lines with their just

share of the costs is less simple. My own method is to separate my payroll each month and charge the wages of all mill men to a mill account, all blackboard men to a blackboard account, and all slaters to a roofing slate account. All bills are likewise separated and charged to the proper account. This leaves the wages of all men working in the quarry itself, the landers, engineers, superintendents, and office help, undistributed because their labor contributes to supply the rock used in all the various branches.

This is also true of the bills for coal, power, and many supplies. Such wage items and bills I charge to an account which I call quarry account. This account is allowed to accumulate during the year, and in closing the books I divide it between the blackboard, mill and roofing slate accounts in the proportions which the values of the three products made during the year bear to each other. By then dividing the number of feet of blackboards produced into the total figures representing the cost of that department for the year, I know with substantial accuracy what my cost per foot has been.

The same process gives me my cost per foot for mill stock and per square for roofing slate. And during recent years the figures thus obtained have been surprisingly high, and have offered no inducement to cut prices.

Moroccan Phosphate May Rival Florida Deposits

ADDITIONAL information as to the phosphate situation in Morocco has become available, says *Chemical and Metallurgical Engineering*. The 1922 production was 80,583 tons. It is estimated that 300,000 tons will be exported in 1923 and that by 1927 a production of 1,100,000 tons will have been attained.

The increase in production is being made possible by the installation of mechanical handling at Casablanca, the port. The narrow-gauge railway connecting Casablanca and the mines is being changed to a broad-gauge line. The influence the broad-gauge railroad will have on the movement of these phosphates is indicated by the fact that the freight rate will be reduced from 52 to 16 francs per ton.

The phosphate beds are situated 160 kilometers south of Casablanca. The beds themselves occur in an area 75 km. in length which varies from 5 to 35 km. in breadth. The beds are in horizontal layers several meters in thickness. The percentage of phosphate is said to average from 73 to 78 per cent. Reports from disinterested sources agree that there are very extensive deposits

of very high-grade phosphate of lime.

For the past two years the deposits have been under the direct control of a state monopoly. It is conducted under a board of management with wide powers vested in a head manager, which gives it the flexibility of administration enjoyed by a private industry. At the same time the enterprise has been benefited greatly by its governmental character, as it has made easy the construction of railways and the providing of port facilities which would have taken a much longer time to arrange had private interests only been concerned.

While the Moroccan authorities claim that a small profit now is being realized from these operations, there is reason to believe that all phosphate exported is being sold at a loss. The development of the deposits, however, and the facilities connected with the whole enterprise are being conducted with assurance because Europe's annual requirements of phosphate exceed 4,000,000 tons. When provisions are complete to handle production and shipments in quantity, there seems little doubt of the ability to compete successfully with the Florida product.

One Use for Old Quarries

IRRA EDWARDS, curator of geology at the Milwaukee public museum, will act as guide for as many Milwaukeeans as care to join the museum's first excursion of the year, at the Edgewood stop of the Oakland avenue car line on a Saturday at 2 p. m., if the weather is not inclement.

The first excursion is a geological study of the formations at the old Milwaukee cement quarry. The Devonian limestone will be studied, and fossils, whose name and classification will be explained by Mr. Edwards, will be collected.

The trip is one of the series which the museum plans each summer for the benefit of the citizens desirous of learning something more about the city and county wild life, natural features, and geography.

Road Building Increases Sand Production

THE great road building program which New Jersey has been carrying on for the past two years is reflected in the figures for the production of sand and gravel in the state during 1921 which have just been tabulated by Assistant State Geologist M. W. Twitchell. These are gathered by the Department of Conservation and Development in co-operation with the U. S. Geological Survey.

Although the total production and value of all sands and gravels were lower than those of several preceding years, road-making sand made an increase of 12 per cent in production and 5 per cent in value over 1920, the previous high year. Gravel used in highway construction also showed an advance. The largest share of these New Jersey products are used within the state.

A total of 3,568,780 short tons of sand and gravel were produced in New Jersey last year, valued at \$2,436,298. The corresponding figures for 1920 were 4,616,444 short tons valued at \$4,330,844. Sand and gravel production is one of the leading mining industries of the state and is the most widely distributed. Pits are found in 16 out of the 21 counties from Sussex to Cape May. Burlington, Cumberland and Middlesex counties lead in the number of producers in the order named.

In 1921 figures for the divisions within the group are as follows: building sand (concrete and mortar), 1,426,327 short tons valued at \$627,232; paving or road-making sand, 632,368 short tons valued at \$345,376; molding sand, 241,587 short tons valued at \$306,209; glass sand, 103,694 short tons valued at \$196,814; cutting and grinding and glass sand, 49,479 short tons valued at \$132,351; engine sand 49,107 short tons valued at \$27,612; other sands, 50,729 short tons valued at \$98,897; and gravel, 1,015,489 short tons valued at \$701,807.

Questions and Answers

Edmund Shaw, Consulting Engineer, Chicago, Ill., Expert on Problems of Screenings, Washing and Hydraulic Separation

THE TECHNICAL STAFF OF ROCK PRODUCTS

Edwin Brooker, Washington, D. C., Consulting Expert on Matters of Transportation and Freight Rates

Gordon Smith, First National Bank Bldg., Chicago, Ill., Expert on Crushing and Cement-Plant Problems

No. 53. Who Originated the Single-Roll Crusher?—Discussion has risen over the question as to the originator of the single-roll crusher. Will you please settle this matter for us?—R. A. J.

A. We are informed by President S. C. McLanahan of the McLanahan-Stone Machine Co. that his company built the first single-roll rock crusher some 28 years ago—the first ever used on rock, coal, or other material. It was designed for use in connection with that company's rock phosphate and iron ore washers. After ascertaining that the principle was right, they built larger sizes which were so successful that they gave up building any other type. "When we applied for a patent on the original single-roll," states this company, "we showed designs with a fixed crushing plate, a swinging plate held in position with springs, and also with breaking blocks. We finally decided that the breaking blocks were the best. Some builders claim great advantage in having the shell made in segments; some make a roll built of discs; others a roll with removable teeth. For hard service our judgment is decidedly in favor of a simple, solid roll shell."—E. H. H.

No. 54. What is "Sorrel Cement?"—Please tell me what is "Sorrel Cement," from what it is made, and any other information you may be pleased to give me.—D. D. D.

A. "Sorrel Cement" is another name for oxychloride or magnesia (MgO) cements. They are made from calcined magnesite (MgCO₃) and magnesium chloride (MgCl₂).—N. C. R.

No. 55. Power Required for Centrifugal Pumps.—Please tell me if the ordinary make-and-break type of gasoline engines are fitted for driving a centrifugal pump. If this is so, how do you determine the size of engine to use?—R. A.

A. This type of engine is suitable for operating a centrifugal pump. The proper procedure in finding what size of engine to use is first to select that size and type which will meet the established requirements for pumping; then select an engine to meet the horsepower and speed needs of the pump. It must be remembered that the speed at which this pump is operated is a controlling factor. If you know the requirements, the proper size of the pump and engine is easily obtained from the manufacturer's tables. As to whether a certain make-or-break engine in service will operate the pump on hand, the only thing to do—in the absence of the maker's advice—is to try out the combination, always making a belt connection rather than a direct connection, knowing that this

pump must be run at a higher speed than the engine, and also provide the means of making such adjustments in speed as the trial of the pump will show are required. If the pump races in starting instead of discharging water, this indicates that the power is more than enough to operate the unit and that the speed is too high; then an adjustment may be made by altering the size of the engine or pump pulleys to produce a lower speed. If the engine shows overloading when the pump is running, the condition may usually be adjusted by putting a gate valve in the discharge line from the pump and throttling the flow. This will have the effect of increasing the pump head. Do not throttle on the suction side; this will usually increase the tendency to race. With repeated trials and adjustments a condition can usually be established under which the pumping engine will work without difficulty, although the combination may not be efficient. When operating, it is also important that all air leakages into the pump should be avoided and precautions taken against allowing the collection of air in the top of the pump chamber. This is prevented by tapping the chamber at the highest point and providing for the discharge of any air which collects there; priming alone is not sufficient to overcome this trouble.—E. H. H.

No. 56. Lime and Tuberculosis.—I am conducting a campaign in Canada along the lines of your splendid article published in *Rock Products*, January 14, 1922. Any help coming from you will be highly appreciated. Many Canadian professors and doctors fail to see anything in the contention that lime is helpful for tuberculosis.—L. H.

A. In the article to which you refer the statement was made that there are some data on the effect of lime and limestone dust on the general health of workers. Among quarrymen and lime manufacturers there is, and apparently always has been, a widespread belief that lime and limestone dust was actually beneficial to persons suffering from respiratory diseases. Doctor Hoffman, in his studies as reported in "Mortality from Respiratory Diseases in Dusty Trades," a U. S. Department of Labor bulletin, has lumped lime-plant and cement-plant workers in the same category. While it is true that cement is made chiefly of lime, there is not supposed to be any "free lime" in portland cement, and, moreover, cement dust contains appreciable amounts of silica. Silica is an *acid*, inert and insoluble in water and most other liquids; limestone is an *alkali*, somewhat soluble in water, and quite soluble in water containing carbon

dioxide. This makes a vast difference in the effect of the dust on the lungs. There is plenty of proof that inhaling silica dust, coal dust, and any other *inert* mineral dust, helps cause tuberculosis. The confusion has come from classifying lime and limestone with inert minerals. Professor Coutiere has reported to the French Academy of Medicine that 40 per cent of the tuberculosis cases in which lime treatment has been tried have resulted in complete cures. The chemical, bacteriological and radiological results are all said to be equally striking in this entirely new method of combatting this dread disease. While the experience of rock products producers cited in our article tends to skepticism as to many cures being effected from inhaling limestone dust, it is generally believed that lime action has stopped the spread of the disease by surrounding the diseased section with a calcareous coating. Other producers assert that many of their employes have come to their plants suffering from tuberculous troubles, and in a short time recovered their health and strength and remained on their jobs for years afterward. Still others say that the men who work in lime plants are unusually healthy and noticeably free from disease. Our letters from these producers have been submitted to the National Tuberculosis Association for study and investigation. As the work of this association has had more to do with occupations which are productive of tuberculosis, *Rock Products* has asked every limestone quarry man and lime plant operator to use his every endeavor to aid and promote scientific investigation in our own field.—N. C. R.

No. 57. Wants a Work on Cost Accounting.—Please give me the names of publishers of books on cost accounting for rock or limestone quarries?—R. E. L.

A. We cannot refer you to a book on cost accounting for quarries; such a thing does not exist. The nearest approach to it is a series of articles on cost accounting system by the General Crushed Stone Co., published in *Rock Products* March 21, 1918, page 25; April 10, page 25; May 8, page 18, and June 19, 1918, page 25. Since then we have published numerous articles along the same line. However, *Rock Products* will shortly publish a series of 10 exclusive articles describing an efficient cost-accounting system, prepared by a well-known New York industrial engineer who will make a thorough-going investigation of the crushed stone industry.—N. C. R.

Quarried from Life

By Liman Sandrock

John, Prince of Good Fellows

TO attempt to tell the sand and gravel industry anything it does not already know concerning John Prince is a task that is hard indeed—it would be mostly reiteration, and trite. But we are sure that many of the industry have not seen the *Kansas City Star's* delightful "who's who" of Mr. Prince, from which we got our inspiration for what we say of him here.

Through the gracious courtesy of Mrs. Prince, we are enabled to present John Prince as a round-cheeked little fellow of six. How frequently do we look over the family album and find a like picture of ourselves? Mother and the children gather about us and join in more or less merriment over our curls, our ankle-ties,



John Prince when he was six years old

our flowing haberdashery and our deceiving look of all-round cherubic innocence.

And then that photo of ourselves when we polished our shoes, slicked down our unruly hair, and gave the tie a final twist, preparatory to appearing with the college glee club, where our best girl sat in the front row and all the other fellows envied us. Those were the happy days!

But, let's begin at the beginning. John Prince was born in Vineland, N. J., on January 3, 1877, the son of William V. Prince and Adelaide Kingman Prince, both of Waterville, Maine—fine New England stock. Passing through the usual



John Prince as he is today

boyish vicissitudes and pranks that are part and parcel of the American youth, he graduated from the grade and high schools and entered Cornell University. He departed from that seat of learning in 1899 with an M. E. degree.

The big thing after college is—a job! He got one, and did his part in building and operating portland cement plants for a while. Then he returned to Cornell, got his M. M. E.—and back again to cement.

Cement was the vehicle that impelled Mr. Prince into Kansas City, in 1906, where he was connected with the building of the Kansas City and the Bonner Springs cement plants. Later he went into general contracting and completed several jobs on the Kansas City Terminal Co.'s development. He also helped found the Prince-Johnson Limestone Co. In 1916 he was called to the Stewart Sand Co. in an advisory capacity, becoming the president on January 1, 1919.

Like other useful and energetic citizens, John Prince has other interests than sand and gravel. He is president of the Safety Council. He was secretary of the waterworks committee; an active head of the War Camp Community Service; and he is

past-president of the local Engineers' Club—always active for civic betterment.

His boyhood ambition? He wanted to be an architect. And how we do miss our youthful aims! Our own son at 6 years of age wanted to be a green-grocer—and we were to carry the coal!

Hobbies? Yes, he delights in building bits of handicraft such as furniture or finishing a self-sailing boat—the latter, by the way, his son's pride and joy. Golf is his recreation, but he sadly says, "I'll always be a member of the Poor Players' Club." His clubs are the Mission Hills Country, the University, Automobile, the Automobile of Missouri, and he is a Chamber of Commerce member.

"I have two ambitions for Kansas City," said he; "I want to see our death rate from accidents cut in half, and a new water plant which will ensure us an adequate supply of pure water for our future needs."

What Mr. Prince stands for in his industry is like good wine; "it needs no bush." Looking over *Rock Products* files we find that he was "largely responsible for the splendid organization developed" when he was district chairman of the mineral aggrega-



He was 22 years old when this picture was taken

gates committee; that as treasurer of the National Sand and Gravel Association the finances were always handled to the best. Secretary Barrows saying in the last association report: "Savings have been effected without impairment of efficiency and without the neglect of a single activity."

Mr. Prince is an engineer of wide vision and has made a deep study of his industry, its needs, and its progress. He is always active in its affairs, working constantly for the good of the order. John Prince is a prince of good fellows, and his many friends love him for his sterling qualities and his fine personality.

Editorial Comment

A recent interview with the general manager of one of the largest quarry companies developed the fact that

The Value of Storage

every one of the company's thirty or more plants was now equipped with a locomotive or tractor crane for handling ground storage. He said: "We now run our plants 11 months in the year instead of eight and stock all sizes of stone." Asked what the extra cost of handling in and out of storage was, he significantly replied that "whatever it was, the stone actually cost less to produce owing to the larger output possible and the regularity of operation."

A dispatch in a New York City newspaper of April 21 reads: "Ten thousand dollars has been offered for an acceptable composition substitute for **From the Edge of Oblivion!** the slate commonly used for billiard table beds by the Brunswick-Balke-Clender Co., whose directors met recently in Chicago. Scarcity of the high grade of slate needed for billiard tables has caused an endeavor to find something more economical which will produce as good or better results." Similar instances could be found where users actually want *slate*, but are compelled to seek substitutes by the lethargy of slate producers.

In the case of the slate quarry industry we have the rather unique instance of people outside the slate industry, who appreciate slate, helping very materially to save the industry from itself. Two men, Dr. Oliver Bowles, of the U. S. Bureau of Mines, and W. S. Hays, secretary of the National Federation of the Construction Industries, have probably done more to wake up the industry than any two slate quarry men—active as some progressive quarry men have been.

From a knowledge of slate, its uses, its methods of production and fabrication, one can readily appreciate the complexity of the industry and its problems. In times gone by these were problems of the individual producer, to be solved by him according to his individual ability and foresight. But other industries have long since learned that modern business is not now so much a matter of competition and survival of the fittest among individuals, as it is competition and survival of whole industries. We have numerous examples of this "new competition" in the cases of concrete vs. brick masonry, lumber vs. concrete, lime plaster vs. gypsum plaster, slag vs. crushed stone and gravel, etc.

Fortunately for slate producers, about 50 per cent of the men in the industry have already seen the light and have succeeded for a year in struggling with some of their problems collectively. They can hardly be said to have solved the problems; but, now that they can meet them with a united front, there is no reason why

such problems cannot be solved. The industry is to be congratulated on having the interest and support of such disinterested helpers as Dr. Bowles and Mr. Hays.

An Illinois sand and gravel producer deserves a vote of thanks from the entire industry. As noted in our

Imposing on Producers

news pages, he has had the "guts" to sue a contractor for breach of contract in failing to accept \$40,000 worth of material, that the producer was made responsible for producing. In times like the present, when every producer can find a ready market for his entire production—and the uninitiated are "hollering" about shortages in basic materials—it is refreshing to see at least one producer give a forceful exposé of a kind of imposition that the majority of producers endure in silence.

In this case, apparently, the sand and gravel producer is in a strong position, having a signed contract for the material. But this merely aggravates a common evasion in which the contractor gets tentative bids or quotations for a large output of material from several producers, subjecting them to the liability of furnishing it all, but mentally reserving for himself the privilege of taking as much or as little as circumstances and exigencies many demand. The obvious result, of course, is that a producer cannot estimate his probable production with any degree of accuracy and must either turn down other prospective customers, or make himself liable for an output greater than his capacity to produce, should all his customers call for full deliveries.

Producers often partially protect themselves by limiting quotations to 30 days, or other specified times; but this is not adequate protection in periods of intensive development as at present. So when the operating year ends, it is usually found that the plants have not produced to capacity, although they may have turned away business, and thus have created the impression that they could not meet current needs. The chances are they could have met every demand, economically, if the industry had been, or could be, organized to compel honorable treatment at the hands of its customers.

The portland cement industry has gone further in fortifying itself against such impositions than any other industry in the rock products field. If every rock products producer would recognize equally well how thoroughly he is the "goat" in such transactions, there would be a more brotherly feeling among them. The contractor takes an unfair advantage, confident that the producer will not risk losing a possible customer; if the producers were alive to their rights and opportunities, such a contractor should be doing a little real worrying about material to supply his actual needs.

The Rock Products Market

Wholesale Prices of Crushed Stone

Prices given are per ton, F. O. B., at producing plant or nearest shipping point

Crushed Limestone

City or shipping point	Screenings, ¾ inch down	¾ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
EASTERN:						
Blakeslee, N. Y.	1.00	1.25	1.10	1.10	1.10	
Buffalo, N. Y.	1.00	1.25	1.30 per net ton all sizes	1.75	1.50	1.50
Chaumont, N. Y.	1.00	1.25	1.75	1.50	1.50	1.50
Cobleskill, N. Y.	1.25	1.25	1.25	1.25	1.25	
Coldwater, N. Y.			1.50 per net ton all sizes	1.35	1.35	1.35
Eastern Penna.	1.35	1.35	1.35	1.35	1.35	1.35
Munns, N. Y.	1.00	1.40	1.40	1.30	1.30	
Prospect, N. Y.	.80	1.30	1.40	1.30	1.30	
Walford, Pa.	1.55	1.55	1.55	1.55	1.55	1.55
Watertown, N. Y.	1.00		1.75	1.50	1.50	1.50
Western New York	.85	1.25	1.25	1.25	1.25	1.25
CENTRAL:						
Alton, Ill.	1.50		1.50	1.35		
Buffalo, Iowa	.70		1.35	1.15	1.20	1.20
Bloomville, Middlepoint, Dun- kirk, Bellevue, Ohio	1.00	1.10	1.10	1.00	1.00	1.00
Chasco, Ill.	1.30	1.25	1.25	1.25	1.20	
Chicago, Ill.	1.10	1.50	1.10	1.10	1.10	1.10
Dundas, Ont.	1.00	1.35	1.35	1.35	1.10	1.10
Greencastle, Ind.	1.25	1.10	1.00	.90@1.00	.90@1.00	.90@1.00
Krause, Columbia and Valmeyer, Ill.	1.00@1.30	1.00@1.30	1.00@1.30	1.00@1.30	1.00@1.30	1.30@1.50
Lannon, Wis.	.80	1.10	1.10	1.00	1.00	.95
Mitchell, Ind.	1.00	1.00	1.00	1.00	1.00	1.00
Montreal, Canada	.90	1.20	1.10	1.00	.95	.95
Montrose, Iowa		1.50	1.60	1.55	1.45	1.40
Sheboygan, Wis.	1.10	1.10	1.10	1.10		
Southern Illinois	1.35	1.25	1.25	1.25	1.20	
Stolle, Ill. (I. C. R. R.)	1.30		1.35	1.35	1.35	1.35
Stone City, Iowa	.75		1.50	1.40	1.35	
Toledo, Ohio	1.60	1.70	1.70	1.70	1.60	1.60
Toronto, Canada	1.90	2.25	2.25	2.25	2.00	2.00
Prices include 90c freight						
Waukesha, Wis.	1.00	1.00	1.00	1.00	1.00	1.00
SOUTHERN:						
Alderson, W. Va.	.75	1.25	1.40	1.25	1.15	
Bridgeport, Texas	1.40	1.40	1.40	1.40	1.25	1.25
Bromide, Okla.	.75	2.00	1.75	1.60	1.50	1.25
Cartersville, Ga.	1.25	1.75	1.75	1.15	1.15	1.15
Chickamauga, Tenn.	1.00@1.25	1.00@1.25	1.10@1.25	1.10@1.25	1.10@1.25	
El Paso, Texas	1.00	1.00	1.00	1.00		
Ft. Springs, W. Va.	.90	1.45	1.45	1.40	1.35	1.30
Garnet and Tulsa, Okla.	.50	1.60	1.60	1.45	1.45	
Ladda, Ga.			1.40	1.40	1.40	
Morris Spur (near Dallas), Tex.	1.25	1.25	1.40	1.40	1.40	1.25
WESTERN:						
Atchison, Kans.	.50	1.90	1.90	1.80	1.80	1.80
Blue Spr'gs and Wymore, Neb.	.20	1.55	1.55	1.45	1.35	1.30
Cape Girardeau, Mo.	1.35		1.10	1.35	1.10	
Kansas City, Mo.	1.00	1.50	1.50	1.50	1.50	1.50

Crushed Trap Rock

City or shipping point	Screenings, ¾ inch down	¾ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Branford, Conn.	.60	1.50	1.35	1.15	1.00	
Bound Brook, N. J.	1.70	2.10	1.80	1.50	1.40	
Dresser Jct., Wis.	1.00	2.25		1.75	2.00	
Duluth, Minn.	.90@1.00	2.25	1.75@2.00	1.35	1.35	1.35
E. Summit, N. J.	1.80	2.30	1.90	1.60	1.40	
Eastern Massachusetts	.85	1.75	1.75	1.40	1.40	1.40
Eastern New York	.75	1.50	1.50	1.30	1.40	1.30
Eastern Pennsylvania	1.25	1.55	1.50	1.40	1.40	1.40
New Britain, Middlefield, Rocky Hill, Meriden, Conn.	.60	1.50@2.00	1.35@1.50	1.15@1.25	1.00@1.10	
Oakland, Calif.	1.75	1.75	1.75	1.75	1.75	
Richmond, Calif.	.50*		1.50*	1.50*	1.50*	
Spring Valley, Calif.	.70	1.55	1.50	1.40	1.35	1.35
Springfield, N. J.	2.00	2.20	2.00	1.75	1.60	1.60
Westfield, Mass.	.60	1.35	1.25	1.10	1.00	

Miscellaneous Crushed Stone

City or shipping point	Screenings, ¾ inch down	¾ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Atlanta, Ga.—Granite	1.47	2.07	2.07	1.97	1.97	
Buffalo, N. Y.—Granite	.90		1.20	1.00	1.05	1.10
Berlin, Utley and Red Granite, Wis.	1.60	1.70	1.60	1.50	1.40	
Columbia, S. C.—Granite	.50		2.00@2.50	2.00	1.75@2.00	
Dundas, Ont.—Limestone	1.00	1.35	1.35	1.25	1.10	1.10
Eastern Penna.—Sandstone	.85	1.60	1.55	1.35	1.35	1.30
Eastern Penna.—Quartzite	1.20	1.35	1.20	1.20	1.20	1.20
Lithonia, Ga.—Granite	1.00		1.50	1.25	1.00	1.00
Lohrville, Wis.—Cr. Granite	1.35	1.40	1.30		1.20	
Middlebrook, Mo.—Granite	3.00@3.50		2.00@2.25	2.00@2.25	1.25@1.50	1.25@1.50
San Diego, Calif.	.50@.70	1.45@1.75	1.40@1.70	1.30@1.60	1.25@1.55	1.25@1.55
Sioux Falls, S. D.—Granite	1.00	1.60	1.55		1.50	

*Cubic yard. †Agrl. lime. ‡R.R. ballast. §Flux. †Rip-rap, a 3-inch and less.

Agricultural Limestone (Pulverized)

Chaumont, N. Y.—Analysis, 95% CaCO ₃ , 1.14% MgCO ₃ —Thru 100 mesh; sacks, 4.00; bulk.....	2.50
Grove City, Pa.—Analysis, 94.89% CaCO ₃ , 1.50% MgCO ₃ ; 60% thru 100 mesh; 45% thru 200 mesh; 100% thru 20 mesh; sacks, 5.00.....	3.50
Hillsville, Pa.—Analysis, 94% CaCO ₃ , 1.40% MgCO ₃ , 75% thru 100 mesh; sacks, 5.00; bulk.....	3.50
Jamesville, N. Y.—Analysis, 89.25% CaCO ₃ ; 5.25% MgCO ₃ ; pulverized, bags, 4.00; bulk.....	2.50
New Castle, Pa.—89% CaCO ₃ , 1.4% MgCO ₃ —75% thru 100 mesh, 84% thru 50 mesh, 100% thru 10 mesh; sacks, 4.75; bulk.....	3.06
Walford, Pa.—Analysis, 50% thru 100 mesh; 4.50 in paper; bulk.....	3.00
Watertown, N. Y.—Analysis, 94% CaCO ₃ ; .02% MgCO ₃ ; 90% thru 100 mesh; bulk, 3.00; sacks.....	4.50
West Stockbridge, Mass., Danbury, Conn., North Pownal, Vt.—Analy- sis, 90% CaCO ₃ —50% thru 100 mesh; paper bags, 4.25—cloth, 4.75; bulk.....	3.00
Alton, Ill.—Analysis, 97% CaCO ₃ , 50% thru 4 mesh.....	4.00
0.1% MgCO ₃ ; 90% thru 100 mesh.....	6.00
Bellevue, Ont.—Analysis, 90.9% CaCO ₃ , 1.15% MgCO ₃ —45% to 50% thru 100 mesh, 61% to 70% thru 50 mesh; bulk.....	2.50
Chasco, Ill.—Analysis, 96.12% CaCO ₃ , 2.5% MgCO ₃ ; 90% thru 100 mesh.....	5.00
90% thru 50 mesh.....	1.35
Detroit, Mich.—Analysis, 88% CaCO ₃ , 7% MgCO ₃ —75% thru 200 mesh, 2.50@4.75—60% thru 100 mesh.....	1.80@3.80
Marblehead, Ohio—Analysis, 93.4% CaCO ₃ , 14.92% MgCO ₃ ; 60% thru 100 mesh; 70% thru 50 mesh; 100% thru 10 mesh; 80-lb. paper sacks.....	5.00
Bulk.....	3.50
Piqua, Ohio—100% thru 100 mesh; bulk, 5.50; bags.....	7.00
50% thru 100 mesh; bulk, 2.10; bags 80% thru 100 mesh; bulk, 3.50; bags	2.25
5.00	
Yellow Springs, Ohio—Analysis, 96.08% CaCO ₃ , 63% MgCO ₃ ; 32% thru 100 mesh; 95.57% sacked, 6.00; bulk.....	4.25
Cape Girardeau, Mo.—Analysis, 93% CaCO ₃ , 3.5% MgCO ₃ ; 50% thru 100 mesh.....	1.50
Hot Springs, N. C.—50% thru 100 mesh; sacks, 4.25; bulk.....	2.70
Knoxville, Tenn.—80% thru 100 mesh 80% thru 200 mesh.....	2.70
(Bags 1.25 extra)	3.50
Linville Falls, N. C.—Analysis, 57% CaCO ₃ , 39% MgCO ₃ ; 50% thru 100 mesh; bulk.....	2.75
Mountville, Va.—Analysis, 76.60% CaCO ₃ , 22.83% MgCO ₃ —50% thru 100 mesh; 100% thru 20 mesh; sacks	5.00
Colton Calif.—Analysis, 95% CaCO ₃ , 3% MgCO ₃ —all thru 20 mesh—bulk	4.00
Lemon Cove, Calif.—Analysis, 94.8% CaCO ₃ , 0.42% MgCO ₃ ; 60% thru 200 mesh; sacks, 5.25; bulk.....	4.50

Agricultural Limestone

(Crushed)

Alton, Ill.—Analysis, 98% CaCO ₃ , 0.1% MgCO ₃ ; 90% thru 50 mesh.....	1.50
Bellevue, Ohio—Analysis, 61.56% CaCO ₃ , 36.24% MgCO ₃ ; ¾ in. to dust, about 20% thru 100 mesh.....	1.25
Bettendorf, Iowa, and Moline, Ill.— 97% CaCO ₃ , 2% MgCO ₃ ; 50% thru 100 mesh; 50% thru 4 mesh.....	1.25
Buffalo, Iowa—90% thru 4 mesh.....	1.00
Cape Girardeau, Mo.—Analysis, 93% CaCO ₃ , 3.5% MgCO ₃ ; 100% thru 10 mesh, 90% thru 50 mesh.....	1.50
90% thru 4 mesh, cu. yd.....	1.35
Chicago, Ill.—Analysis, 53.63% CaCO ₃ , 37.51% MgCO ₃ ; 90% thru 4 mesh.....	.80
Columbia, Ill., near East St. Louis— ¾-in. down.....	1.25@1.80
Elmhurst, Ill.—Analysis, 35.73% CaCO ₃ , 20.69% MgCO ₃ ; 50% thru 50 mesh.....	1.25
Huntington and Bluffton, Ind.—Analy- sis, 61.56% CaCO ₃ , 36.24% MgCO ₃ ; about 20% thru 100 mesh.....	1.25

(Continued on next page)

Agricultural Limestone

(Continued from preceding page)

Greencastle, Indiana.—Analysis, 98% CaCO ₃ ; 50% thru 50 mesh.....	2.00
Kansas City, Mo.—50% thru 100 mesh.....	1.50
Krause and Columbia, Ill.—Analysis, 90% CaCO ₃ ; 90% thru 4 mesh.....	1.20
Lannon, Wis.—Analysis, 54% CaCO ₃ ; 44% MgCO ₃ ; 99% thru 10 mesh; 46% thru 60 mesh.....	2.00
Screenings (1/4 in. to dust).....	1.00
Marblehead, Ohio.—Analysis, 83.54% CaCO ₃ ; 14.92% MgCO ₃ ; 32% thru 50 mesh; 31% thru 50 mesh; 100% thru 4 mesh; 83% thru 10 mesh; bulk.....	1.25
Milfords, Indiana.—Analysis, 94.41% CaCO ₃ ; 2.95% MgCO ₃ ; 33.6% thru 100 mesh, 40% thru 50 mesh.....	1.25@ 1.65
Mitchell, Ind.—Analysis, 97% CaCO ₃ ; 1% MgCO ₃ ; 50% thru 100 mesh, 90% thru 4 mesh.....	1.25
Montrose, Iowa.—90% thru 100 mesh, 43% MgCO ₃ ; limestone screenings, 37% thru 100 mesh, 55% thru 50 mesh, 100% thru 4 mesh.....	1.25
Narbo, Ohio.—Analysis, 56% CaCO ₃ ; 43% MgCO ₃ ; limestone screenings, 37% thru 100 mesh, 55% thru 50 mesh, 100% thru 4 mesh.....	1.50@ 2.00
Ohio (different points), 20% thru 100 mesh, bulk.....	1.25@ 1.50
Piqua, Ohio.—100% thru 4 mesh.....	1.55
River Rouge, Mich.—Analysis, 54% CaCO ₃ ; 40% MgCO ₃ ; bulk.....	.80@ 1.40
Stolle, Ill., near East St. Louis on I. C. R. R.—Thru 1/4-in. mesh.....	1.30
Stone City, Iowa.—Analysis, 98% CaCO ₃ ; 50% thru 50 mesh.....	.75
Toledo, Ohio.—1/4 in. to dust, 30% thru 100 mesh.....	1.50
Waukesha, Wis.—No. 1 kiln dried.....	1.75
No. 2 Natural.....	1.75
Alderson, W. Va.—Analysis, 90% CaCO ₃ ; 90% thru 50 mesh.....	1.75
Cape Girardeau, Mo.—Analysis, 93% CaCO ₃ ; 3.5% MgCO ₃	2.00
90% thru 4 mesh.....	1.50
Cartersville, Georgia.—Analysis, 54% CaCO ₃ ; 44% MgCO ₃ —all passing 10 mesh.....	1.75
Claremont, Va.—Analysis, 92% CaCO ₃ ; 2% MgCO ₃ ; 90% thru 50 mesh.....	3.00
50% thru 50 mesh, 90% thru 4 mesh, 50% thru 4 mesh.....	2.75
Ft. Springs, W. Va.—Analysis, 90% CaCO ₃ ; 50% thru 100 mesh.....	1.50
Ladda, Ga.—50% thru 50 mesh.....	2.00
Garnett, Okla.—Analysis, 80% CaCO ₃ ; 3% MgCO ₃ ; 50% thru 50 mesh.....	.50
Kansas City, Mo., Corrigan Siding—50% thru 100 mesh; bulk.....	1.80
Tulsa, Okla.—90% thru 4 mesh.....	.50

Miscellaneous Sands

Silica sand is quoted washed, dried and screened unless otherwise stated.

Glass Sand:	
Berkeley Springs, W. Va.....	2.25@ 2.50
Cedarville and South Vineland, N. J.—Damp, 1.75; dry.....	2.25
Cheshire, Mass.—Damp.....	2.50
Columbus, Ohio.....	1.50@ 2.00
Dunbar, Pa.—Damp.....	2.50
Falls Creek, Pa.....	2.25
Hancock, Md.—Damp, 1.50; dry.....	2.00
Kiondia and Pacific, Mo.....	2.00@ 2.50
Mapleton, Pa.....	2.25@ 2.50
Mapleton Denot, Pa.—Dry.....	2.75
Massillon, Ohio.....	3.50
Michigan City, Ind.....	.50@ .55
Millville, N. J.—Wet, 1.75; dry.....	2.25
Mineral Ridge, Ohio.....	3.00
Montoursville, Pa.....	2.00
Oregon, Ill.....	2.50
Ottawa, Ill.....	1.50@ 1.75
Pittsburgh, Pa.—Dry, 4.00; damp.....	3.00
Rockwood, Mich.....	2.50@ 2.75
Round Top, Md.....	2.25@ 2.50
Sands, Pa.....	3.00@ 3.50
San Francisco, Calif.....	3.00@ 3.50
St. Louis, Mo.....	1.25@ 2.50
St. Mary's, Pa.....	2.50
Thayers, Pa.....	2.50
Utica, Ill.....	1.75
Zanesville, Ohio.....	2.00@ 2.50
Foundry Sand:	
Albany, N. Y.—Molding fine, coarse and brass molding.....	2.25@ 4.00
Sand blast (kiln dried).....	2.25@ 4.00
Allentown, Pa.—Core and molding fine.....	1.75@ 2.00
Arenville, Ill.—Molding fine.....	1.50@ 1.75
Brass molding.....	1.75@ 2.00
Beach City, Ohio.—Core, washed and screened.....	2.00@ 2.50
Furnace lining.....	2.50@ 3.00
Molding fine and coarse.....	2.25@ 2.50
Cheshire, Mass.—Furnace lining, molding fine and coarse.....	5.00@ 8.00
Stone sawing.....	6.00
Cleveland, Ohio.—Molding coarse.....	1.50@ 2.00
Brass molding.....	1.50@ 2.00
Molding fine.....	1.50@ 2.25
Core.....	1.25@ 1.50

(Continued on next page)

Wholesale Prices of Sand and Gravel

Prices given are per ton, f.o.b., at producing plant or nearest shipping point

Washed Sand and Gravel

City or shipping point	Fine Sand, 1/10 in. down	Sand, 1/4 in. and less	Gravel, 1/2 in. and less	Gravel, 1 in. and less	Gravel, 1 1/2 in. and less	Gravel, 2 in. and less
EASTERN:						
Attica, N. Y.....	.75	.75	.75	.75	.75	.75
Ambridge and So. Heights, Pa.....	1.25	1.25	1.25	.85	.85	.85
Buffalo, N. Y.....	1.10	.95			.85	
Erie, Pa.....	.75		.90		1.10	
Farmingdale, N. J.....	.48	.48	.75	1.10	1.10	
Hartford, Conn.....	.90		1.25	1.15	1.15	1.15
Leeds Junction, Me.....		.50	1.75	1.35	1.35	1.25
Machias, N. Y.....	.85	.75	.95	.85	.85	.85
Pittsburgh, Pa.....	1.25	1.25	1.25	.85	.85	.85
Portland, Me.....		.50	1.75		1.35	1.35
Washington, D. C. (Rewashed, river)	.75	.75	1.60	1.40	1.20	1.20
CENTRAL:						
Alton, Ill.....		.85				
Anson, Wis.....	.50	.40				.90
Barton, Wis.....		.40@ .60		.50@ .70	.50@ .70	
Beloit, Wis.....		.70			.80	
Chicago, Ill.....	1.75@ 2.25	1.75@ 2.43				
Cincinnati, Ohio.....	.70	.65	.90	.90	.90	.90
Columbus, Ohio.....	.75@ 1.00	.75@ 1.00	.65@ 1.00	.75@ 1.00	.75@ 1.00	.75@ 1.00
Des Moines, Iowa.....	.50	.50	1.60	1.60	1.60	1.60
Dresden, Ohio.....	.70	.60				
Earlestead (Flint), Mich.....	.70					.85@ .90
Eau Claire, Wis.....	.40	.40@ .45	1.00@ 1.25			.70
Elkhart Lake, Wis.....	.66		.80			
Ft. Dodge, Iowa.....		1.22		2.17		
Grand Rapids, Mich.....		.50		.80		.70
Hamilton, Ohio.....						.90
Hawarden, Iowa.....	.60	.50			1.60	
Hersey, Mich.....	.50	.50			.75	.75
Indianapolis, Ind.....	.60	.60		1.50	.75@ 1.00	.75@ 1.00
Janesville, Wis.....		.65@ .75			.65@ .75	
Mason City, Iowa.....	.65	.65	1.75		.75	1.65
Mankato, Minn. (pit run).....	.60	.50			1.35	
Milwaukee, Wis.....	1.11	1.11	1.36	1.36	1.36	1.36
Minneapolis, Minn.....	.35	.35	1.25@ 1.35	1.25@ 1.35	1.25	1.25
Moline, Ill.....	1.00	1.00	1.30	1.30	1.30	1.30
Riton, Wis.....		.40			.60	
St. Louis, Mo., f.o.b. cars.....	1.20	1.45		1.45	1.45	1.45
St. Louis, Mo., deliv. on job.....	2.05	2.20	2.35	2.15		2.10
Summit Grove, Clinton, Ind.....	.65@ .75	.60@ .75	.60@ .75	.60@ .75	.60@ .75	.60@ .75
Terre Haute, Ind.....	.75	.60	1.00	.75	.75	.75
Waukesha, Wis.....	.50	.50	.80	.80	.80	.80
Winona, Minn.....	.50	.50	1.25	1.25	1.10	1.10
(0.5 ton discount 10 days)						
Atlanta, Ga.....	.75	.75		.90	.90	.90
Birmingham, Ala.....	1.48		all gravel 1.88			
Charleston, W. Va.....	all sand 1.40		all gravel 1.50			
Estill Springs, Tenn.....	1.35	1.35		1.00	.85	.65
Ft. Worth, Texas.....	1.75	1.75		1.75	1.75	1.75
Jackson's Lake, Ala.....	.50@ .60	.50@ .60	.40@ 1.00	1.00	.50@ 1.00	.50@ 1.00
Knoxville, Tenn.....	1.00	1.00	1.00	1.00	1.00	1.00
Lake Weir, Fla.....		.60				
Macon, Ga.....	.50@ .75					
Memphis, Tenn.....	1.00	1.00	1.80	1.80	1.80	1.80
N. Martinsville, W. Va.....	1.00	1.00		1.20	1.00	.80
New Orleans, La.....	.25			.85		
Roseland, La.....	.50		.85			
WESTERN:						
Grand Rapids, Wyo.....	.50	.50	.85	.85	.80	.80
Kansas City, Mo.....			(Kaw river sand, car lots, .75 per ton; Missouri river, .85)			
Los Angeles, Calif.....	.70	1.20	1.20	1.20	1.10	1.10
Pueblo, Colo.....	1.10*	.90*		1.50*		
San Diego, Calif.....	.50@ .70	.80@ 1.00	1.30@ 1.80	1.35@ 1.65	1.10@ 1.40	1.10@ 1.40
San Francisco, Calif.....	1.00	1.00	1.00@ 1.20	.85@ 1.00	.85@ 1.00	.85@ 1.00
Seattle, Wash.....	1.25*	1.25*	1.50*	1.25*	1.25*	1.25*
Spring Valley, Calif.....	.70	.80	1.40	1.35	1.25	1.25

Bank Run Sand and Gravel

City or shipping point	Fine sand, 1/10 in.	Sand, 1/4 in.	Gravel, 1/2 in.	Gravel, 1 in.	Gravel, 1 1/2 in.	Gravel, 2 in.
Atlanta, Ga.....	.30@ .40	.30@ .40				
Boonville, N. Y.....	.60@ .80		.55@ .75			1.00
Cape Girardeau, Mo.....			River sand, .80 per yd.			
Cherokee, Iowa.....		.60	.80 per ton—1.20 washed			
Dresden, Ohio.....	1.00	1.00		.90		
Dudley, Ky. (crushed sand).....			.65 per cu. yd.			
East Hartford, Conn.....		.50			.60	.60
Elkhart Lake, Wis.....	.70					.85
Estill Springs, Tenn.....		.50@ .65		.50@ .65		.50
Fishers, N. Y.....						
Grand Rapids, Mich.....			1.00*			.60
Hamilton, Ohio.....						
Hartford, Conn.....				.55		
Hersey, Mich.....						
Indianapolis, Ind.....			Mixed gravel for concrete work, .65			.55
Lindsay, Texas.....		1.00			.65@ .75	
Janesville, Wis.....		.65				
Montezuma, Ind.....			Road gravel .50 per ton			
Pine Bluff, Ark.....			Road gravel .50			
Rochester, N. Y.....	.60@ .75	.60@ .75		.50@ .65	.50@ .65	.50@ .65
Roseland, La.....		.75		1.30	1.30	1.30
Saginaw, Mich., f.o.b. cars.....		.75				
St. Louis, Mo.....			Bank run gravel 1.55			
Summit Grove, Ind.....	.50	.50	.50	.50	.50	.50
Waco, Texas.....		.80		1.50		1.30
Winona, Minn.....						
York, Pa.....		1.00@ 1.20				
Clean pit run .60 (crushed rock sand)						

* Cubic yard. B Bank. L Lake. || Ballast. † Low prices, wholesale; high prices, retail.

Crushed Slag

City or shipping point	Roofing	¼ in. down	½ in. and less	¾ in. and less	1½ in. and less	2½ in. and less	3 in. and larger
EASTERN:							
Buffalo, N. Y.	2.35	1.35	1.35	1.35	1.35	1.35	1.35
E. Canaan, Conn.	4.00	1.00	2.50	1.35	1.25	1.15	1.15
Eastern Penn. and Northern N. J.	2.00	1.20	1.50	1.20	1.20	1.20	1.20
Easton, Pa.	2.50	.80	1.25	.90	.85	.80	.80
Erie, Pa.		Crushed run slag, 4 in. and less, 1.25@1.35					
Emporium, Pa.			1.35	1.35	1.35	1.35	1.35
Sharpsville and West Middlesex, Pa.	2.00	1.30	1.70	1.30	1.30	1.30	1.30
Western Penn.	2.00	1.25	1.50	1.25	1.25	1.25	1.25
CENTRAL:							
Chicago, Ill.		All sizes, 1.50, f.o.b. Chicago					
Detroit, Mich.		All sizes, 1.65, f.o.b. Detroit					
Ironton, O.	2.05	1.45	1.75	1.45	1.45	1.45	1.45
Steubenville, O.	2.00	1.40	1.70	1.40	1.40	1.40	1.40
Toledo, O.	1.50	1.35	1.35	1.35	1.35	1.35	1.35
Youngstown, Dover, Hubbard, Letonia, Struthers, O.	2.00	1.25	1.35	1.35	1.25	1.25	1.25
Steubenville, Lowellville, Canton, O.	2.00	1.35	1.60	1.35	1.35	1.35	1.35
SOUTHERN:							
Alabama City, Ala.	2.05	.80	1.25	1.15	1.10	.95	.85
Ashland, Ky.		1.55		1.55	1.55	1.55	1.55
Ensley, Ala.	2.05	.80	1.25	1.15	1.10	.95	.85
Longdale, Goshen, Glen Wilton and Low Moor, Roanoke, Va.	2.50	1.00	1.25	1.25	1.25	1.15	1.05

Lime Products (Carload Prices Per Ton F.O.B. Shipping Point)

	Finishing hydrate	Masons' hydrate	Agricultural hydrate	Chemical hydrate	Ground burnt lime, Blk. Bags	Lump lime, Bbl.
EASTERN:						
Adams, Mass.			7.00		2.90	
Bellefonte, Pa.		10.50	10.50	10.50	9.00	8.50
Buffalo, N. Y.				12.50		
Berkeley, Pa.			12.00			2.30
Cassadaga, N. Y.			Agricultural marl 7.00@10.00			
Chaumont, N. Y.					2.50	4.00
Lime Ridge, Pa.						5.00
West Rutland, Vt.	13.50	12.00				11.00
West Stockbridge, Mass.						3.20
Williamsport, Pa.			10.00		10.00	6.00
York, Pa. (dealers' prices)		10.50	10.50			
Zylonite, Mass.	3.20d	2.90d	7.00			
CENTRAL:						
Cold Springs, Ohio	11.50	10.00	10.00		8.00	10.00
Delaware, Ohio	12.50	11.00	10.00	11.50		9.00
Gibsonburg, Ohio	12.50		10.00		9.00	10.00
Huntington, Ind.		11.00	10.00		8.00	9.00
Luckey, Ohio	12.50a		10.00a		9.00	
Marblehead, Ohio		11.00	10.00			10.00
Marion, Ohio		11.00	10.00			10.00
Mitchell, Ind.				12.00	11.00	10.00
Sheboygan, Wis.						7.50d
White Rock, Ohio	12.50				9.00	11.00
Woodville, O. (dlrs.' price)	12.50a	11.00a	10.50a		9.00	10.00
SOUTHERN:						
Erin, Tenn.						8.50
El Paso, Tex.						1.50
Karo, Va.						7.00
Knoxville, Tenn.	12.50	11.00		11.00		9.00
Ocala and Zuber, Fla.	14.00	14.00		14.00		1.75
Sherwood, Tenn.	12.50	11.00	11.00	11.00		8.50
Staunton, Va.					4.50	5.50
WESTERN:						
Colton, Calif.			15.00			19.70
Kirtland, N. M.						15.00
San Francisco, Calif.	21.00	21.00	15.00	21.00		2.15*
Tehachapi, Calif.						13.00

*100-lb. sacks; *180-lb. net, price per barrel; *180-lb. net, non-returnable metal barrel; \$paper sacks. (a) 50-lb. paper bags; terms, 30 days net, 25c per ton or 5c per barrel discount for cash in 10 days from date of invoice; (b) burlap bags; (c) 200-lb. barrels; (d) 280-lb. barrels net.

Miscellaneous Sands

(Continued from preceding page)

Columbus, Ohio.—Core	.50@ 2.00
Sand blast	4.50@ 5.50
Molding fine	2.75@ 3.00
Molding coarse	2.00@ 2.50
Brass molding	2.50
Furnace lining	2.00
Molding coarse	1.75@ 2.00
Stone sawing	1.50
Traction	.70@ 1.00
Delaware, N. J.—Molding fine	2.00
Molding coarse	1.90
Brass molding	2.15
Dunbar, Pa.—Traction, damp	2.50
Dundee, Ohio.—Glass, core, sand blast	
traction	2.50
Molding fine, brass molding (plus 75c for winter loading)	2.00
Molding coarse (plus 75c for winter loading)	1.75
Eau Claire, Wis.—Core	1.00@ 1.25
Sand blast	3.25@ 3.75
Falls Creek, Pa.—Molding, fine and coarse	1.75
Sand blast	2.00
Traction	1.75
Franklin, Pa.—Core	2.00
Furnace lining	2.50
Molding fine and coarse	2.00
Brass molding	2.00
Greenville, Ill.—Molding coarse	1.30@ 1.50
Joliet, Ill.—No. 2 molding sand and loam for luting purposes; milled	.80
Bank run	.65

Kansas City, Mo.—Missouri river core	.80
Kasota, Minn.—Molding fine	1.60@ 1.85
Molding coarse, stone sawing	1.45@ 1.75
Klondike, Pacific, Gray Summit, Mo.—	
Molding fine, core, sand blast, stone sawing	2.00
Mapleton, Pa.—Glass, core, furnace lining, molding fine and coarse; damp, 2.00; dry	2.75
Massillon, Ohio—Molding fine and coarse, furnace lining, core	3.00
Traction	2.75
Michigan City, Ind.—Core, traction	.40@ .45
Mineral Ridge, Ohio.—Core (green)	2.25
Furnace lining, molding fine and coarse; roofing sand, sand blast, stone sawing, traction brass molding (green)	2.00
Montoursville, Pa.—Core	1.35@ 1.40
Traction	1.00@ 1.10
Brass molding	1.25
New Lexington, Ohio—Molding fine	2.25
Molding coarse	2.00
(75 extra per ton for winter loading)	
Oregon, Ill.—Core	1.50@ 2.00
Sand blast	4.00
Stone sawing	2.00@ 2.50
Ottawa, Ill.—Core, roofing, brass molding	1.75@ 2.50
Furnace lining, traction	1.50
Sand blast	4.50
Ottawa, Minn.—All crude silica sand	.75@ 1.00
Rockwood, Mich.—Core	1.90@ 2.50
Roofing	2.75
Sand blast	3.75

Miscellaneous Sands

(Continued)

Round Top, Md.—Core	1.60@ 1.75
Traction	1.75
Sand blast	2.00@ 2.50
San Francisco, Calif. (washed and dried)—Core, molding fine, roofing sand and brass molding	3.00@ 3.50
(Direct from pit)	
Furnace lining, molding coarse, sand blast	3.60
Stone sawing, traction	2.30
St. Louis, Mo.—Red heavy molding	1.50@ 2.25
Red fine	1.50@ 2.00
Molding fine and brass	2.00@ 3.00
Skein core	1.50@ 2.00
White core sand	1.00@ 1.75
Sand blast	2.00@ 4.00
Furnace lining	1.50@ 2.50
Thayers, Pa.—Core and traction	1.25
Furnace lining	1.10
Molding fine and coarse	1.00
Utica, Ill.—Core	1.25
Furnace lining	.90
Molding fine	1.00
Molding coarse	1.75
Roofing sand	2.50@ 3.50
Sand blast	1.50@ 1.75
Stone sawing	1.00@ 1.75
Traction	1.50@ 2.50
Brass molding (crude and dry)	1.00@ 1.75
Utica, Ill.—Core, furnace lining, brass molding	1.00@ 1.75
Molding fine and coarse	.85@ 1.75
Roofing sand and traction	2.50@ 3.50
Sand blast	1.75@ 2.50
Warwick, Ohio.—Core, furnace lining, molding, fine and coarse, traction, dry, 2.75; green	2.00
Brass molding, dry	2.50
Zanesville, Ohio.—Molding fine, brass molding	1.50@ 1.75
Molding coarse	1.50

Talc

Prices given are per ton f.o.b. (in carload lots only), producing plant, or nearest shipping point.

Asheville, N. C.—Crude talc	4.50
Ground talc (20-50 mesh), bags	6.50
Ground talc (150-200 mesh), bags	3.50
Baltimore, Md.—Crude talc (mine run)	8.00
Ground talc (20-50 mesh), bags	10.00
Ground talc (150-200 mesh), bags	12.00
Cubes	50.00
Blanks (per lb.)	.07
Chatsworth, Ga.—Grinding	7.00
Ground talc (150-200 mesh); bags	15.00
Pencils and steel workers' crayons (gross)	1.50@ 2.50
Chester, Vt.—Ground talc (150-200 mesh), bulk	6.50@ 8.50
(Bags 1.00 extra)	
Emeryville, N. Y.—325 mesh (double air floated), bags	14.75
Glendale, Calif.—Ground talc (150-200 mesh)	16.00@ 30.00
(Bags extra)	
Ground talc (50-300 mesh)	13.50@ 15.50
200 mesh	13.50@ 14.50
Halesboro, N. Y.—Ground talc (150-200 mesh), bags	18.00
Henry, Va.—Crude talc (lump mine run) per 2000-lb. ton	2.75@ 3.50
Ground talc (20-50 mesh), bags	8.75@ 10.00
(150-200 mesh), bags	9.75@ 12.50
Los Angeles, Calif.—Crude talc f.o.b. Silver Lake	7.00@ 12.00
Ground talc (150-200 mesh), 100-200 lb. bags	12.00@ 14.00
Mertztown, Pa.—Ground talc (20-50 mesh); bulk, 5.00; bags	6.00
(150-200 mesh); bulk, 7.00; bags	8.00
Natural Bridge, N. Y.—Ground talc (150-200 mesh) bags	12.00@ 13.00
Rochester and East Granville, Vt.—Ground talc (20-50 mesh), bulk	8.50@ 10.00
(Bags extra)	
Ground talc (150-200 mesh), bulk	10.00@ 22.00
(Bags extra)	
Vermont—Ground talc (20-50 mesh); bags	7.50@ 10.00
Ground talc (150-200 mesh); bags	8.50@ 15.00
Waterbury, Vt.—Ground talc (20-50 mesh), bulk	5.00
(Bags 1.00 extra)	
Ground talc (150-200 mesh), bulk	8.00@ 14.00
(Bags 1.00 extra)	
Pencils and steel workers' crayons, per gross	1.20@ 2.00

Rock Phosphate

(Raw Rock)

Per 2240-lb. Ton

Centerville, Tenn.—B.P.L. 65%	6.00@ 8.50
B.P.L. 65%	6.00
Gordonsburg, Tenn.—B.P.L. 68-72%	4.50@ 5.00
Tennessee—F.o.b. mines, long tons, unground Tennessee brown rock, 72% B.P.L.	7.00
Mt. Pleasant, Tenn.—Analysis, 65% B.P.L. (2000 lb.)	6.50
Paris, Idaho—2000 lb. mine run, B.P.L. 70%	3.50

(Continued on next page)

Roofing Slate

The following prices are per square (100 sq. ft.) for Pennsylvania Blue-Gray Roofing Slate, f. o. b. cars quarries:

Sizes	Genuine Bangor, Washington Big Bed, Franklin	Genuine Albion	Slatington Small Bed	Genuine Bangor Ribbon
24x12.....	\$10.20	\$8.40	\$8.10	\$7.50
24x14.....	10.20	8.40	8.40	7.80
22x12.....	10.80	8.70	8.40	7.80
22x11.....	10.80	8.70	8.40	7.80
20x12.....	12.60	9.00	8.70	8.10
20x10.....	12.60	9.00	8.70	8.10
18x10.....	12.60	9.00	8.70	8.10
18x 9.....	12.60	9.00	8.70	8.10
16x10.....	12.60	8.70	8.40	7.80
16x 9.....	12.60	8.70	8.40	7.80
16x 8.....	12.60	8.70	8.40	7.80
18x12.....	12.60	8.70	8.40	7.80
16x12.....	11.10	8.40	8.10	7.50
14x10.....	11.10	8.40	8.10	7.50
14x 8.....	11.10	8.40	8.10	7.50
14x 7 to 12x6.....	9.30	8.10	7.50	7.50
	Mediums	Mediums	Mediums	Mediums
24x12.....	\$ 8.10	\$8.10	\$7.20	\$5.75
22x11.....	8.40	8.40	7.50	5.75
Other sizes.....	8.70	8.70	7.80	5.75

For less than carload lots of 20 squares or under, 10% additional charge will be made.

(Continued from preceding page)

(Ground Rock)

Wales, Tenn.—B.P.L. 70%.....	7.75	Granville, N. Y.—Red slate granules.....	7.50
Barton, Fla.—Analysis, 50-65% B.P.L. 3.50@ 8.00		Harrisonburg, Va.—Blk. marble (crushed, in bags).....	12.50
Centerville, Tenn.—B.P.L. 60-65%.....	6.50	Ingomar, Ohio (in bags) 6.00@14.00	10.00@25.00
B.P.L. 75% (brown rock).....	12.00	Milwaukee, Wis.....	16.00@35.00
Columbia, Tenn.—B.P.L. 68-72%.....	5.50	New York, N. Y.—Red and yellow Verona.....	32.00
B.P.L. 65% (90% thru 200 mesh).....	5.50	Middlebrook, Mo.—Red Phillipsb'g, N. J.—Green stucco dash.....	25.00@30.00
Montpelier, Idaho.—Analysis, 72% B.P.L., crushed and dried.....	3.75	Poultney, Vt.—Slate granules.....	7.50
Mt. Pleasant, Tenn.—B.P.L. 65%.....	6.50@ 7.00	Red Granite, Wis.....	7.50
Twomey, Tenn.—B.P.L. 65%.....	6.50	Sioux Falls, S. D.....	7.50
		Tuckahoe, N. Y.....	8.00@12.00
		Whitestone, Ga.—White marble chips, net ton in bulk, f.o.b., bags 12½c extra.....	4.50

Florida Soft Phosphate

(Raw Land Pebble)

Per Ton	
Florida—F. o. b. mines, long ton, 68/66% B.P.L.....	3.00
68% (min.).....	3.25
70% (min.).....	3.50
Jacksonville (Fla.) District.....	10.00@12.00

(Ground Land Pebble)

Per Ton	
Jacksonville, Fla., District.....	14.00
Add 2.50 for sacks.....	
Morristown, Fla.—26% phos. acid.....	16.00
Mt. Pleasant, Tenn.—65-70% B.P.L.....	5.00@ 6.00

Fluorspar

Fluorspar—80% and over calcium fluoride, not over 5% silica; per ton f.o.b. Illinois and Kentucky mines.....	20.00
Fluorspar—85% and over calcium fluoride, not over 5% silica; per ton f.o.b. Illinois and Kentucky mines.....	21.50

Special Aggregates

Prices are per ton f. o. b. quarry or nearest shipping point.		
City shipping point	Terrazzo	Stucco chips
Chicago, Ill.—Stucco chips, in sacks f.o.b. quarries.....		17.50
Deerfield, Md.—Green; bulk.....	7.00	7.00
Easton, Pa.—Evergreen, creme green and royal green marble.....	14.00@16.00	16.00@18.00
Slate granules.....		7.00

Concrete Brick

Prices given per 1000 brick, f.o.b. plant or nearest shipping point.

	Common	Face
Appleton, Minn.....	22.00	27.00@35.00
Carpenterville, N. J.....	15.00	23.00@36.00
Easton, Pa.....	16.00	40.00@60.00
Fresno, Ala.....	13.00	21.75
Eugene, Ore.....	25.00@26.00	50.00@75.00
Friesland, Wis.....	22.00	32.00
Houston, Tex.....		19.50
Omaha, Neb.....	18.00	30.00@40.00
Portland, Ore. (De'd).....	21.00	45.00@75.00
Puyallup, Wash.....	18.00	40.00@75.00
Rapid City, S. D.....	18.00	25.00@40.00
St. Paul, Minn.....	15.00	30.00@37.50
Salem, Ore.....	25.00	35.00@50.00
Salt Lake City, Utah.....	17.00@18.00	35.00@40.00
Springfield, Ill.....	18.00	20.00@25.00
Wauwatosa, Wis.....	13.00@14.00	25.00@65.00
Watertown, N. Y.....	21.00@22.50	35.00@37.50
Winnipeg, Can.....	18.00	26.00

Sand-Lime Brick

Prices given per 1,000 brick f. o. b. plant or nearest shipping point, unless otherwise noted.	
Barton, Wis.....	11.00
Boston, Mass.....	15.00@16.50
Buffalo, N. Y.....	16.50
Dayton, Ohio.....	12.50@13.50
El Paso, Texas.....	14.00
Grand Rapids, Mich.....	12.00
Lancaster, N. Y.....	14.00
Michigan City, Ind.....	11.00

Milwaukee, Wis. (delivered).....	14.00
Minneapolis, Minn.....	13.00
Plant City, Fla.....	10.00
Portage, Wis.....	15.00
Rives Junction, Mich.....	12.00
Saginaw, Mich.....	12.00
San Antonio, Texas—Common.....	15.00
South Dayton, Ohio.....	12.50@13.50
Syracuse, N. Y. (delivered at job).....	17.00
F. o. b. cars.....	15.00
Washington, D. C.....	14.50

Lime

Warehouse prices, carload lots at principal cities. Hydrate per Ton

	Finishing	Common
Atlanta, Ga.....	23.00	20.00
Baltimore, Md.....	22.00	16.25
Cincinnati, Ohio.....	15.80	13.30
Chicago, Ill.....	18.00	18.00
Dallas, Tex.....	22.50	
Denver, Colo.....	24.00	
Detroit, Mich.....	19.50	17.50
Kansas City, Mo.....	25.60	24.00
Minneapolis, Minn. (white).....	25.50	21.00
Montreal, Que.....	21.00	21.00
New Orleans, La.....	17.25	
New York, N. Y.....	16.80	13.10
Philadelphia, Pa.....	15.50	14.50
St. Louis, Mo.....	21.40	19.20
San Francisco, Calif.....	22.00	16.00
Seattle, Wash. (paper sacks).....	24.00	

Portland Cement

Current prices per barrel in carload lots f. o. b. cars, without bags.

Atlanta, Ga.....	2.80
Boston, Mass.....	3.18†
Buffalo, N. Y.....	3.03†
Cedar Rapids, Iowa.....	2.48
Cincinnati, Ohio.....	2.54
Cleveland, Ohio.....	2.46
Chicago, Ill.....	2.20
Dallas, Tex.....	2.25
Davenport, Iowa.....	2.43
Denver, Colo.....	2.65
Detroit, Mich.....	2.47
Duluth, Minn.....	2.14
Indianapolis, Ind.....	2.41
Kansas City, Mo.....	2.45
Los Angeles, Calif. (less 5c discount).....	3.16
Milwaukee, Wis.....	2.37
Minneapolis, Minn.....	2.39
Montreal, Can. (sacks 20c extra).....	2.40
New Orleans, La.....	2.83
New York, N. Y.....	2.80†
Philadelphia, Pa.....	2.96†
Phoenix, Ariz.....	3.70
Pittsburgh, Pa.....	2.24
Portland, Ore.....	3.05
San Francisco, Calif.....	3.03@3.15**
St. Louis, Mo.....	2.35
Seattle, Wash.....	2.39
St. Paul, Minn.....	2.90*
Toledo, Ohio.....	2.48

NOTE—Add 40c per bbl. for bags.

**+warehouse.

†Including sacks; 10c bbl. discount 10 days.

*10c bbl. discount.

F. O. B. Mine Prices, Bulk

Buffington, Ind.....	1.95
Cincinnati, Ohio.....	3.00†
Concrete, Wash.....	2.60
Hudson, N. Y.....	2.85†
Dayton, Ohio.....	2.96†
Indianapolis, Ind.....	2.92†
Louisville, Ky.....	3.24†
Memphis, Tenn.....	1.95
Steeleton, Minn.....	2.00
Universal, Pa.....	2.00

†Includes 15c bags; will be repurchased if in good condition.

†Including cloth sacks.

Gypsum Products—CARLOAD PRICES PER TON AND PER M SQUARE FEET, F. O. B. MILL

	Crushed Rock	Ground Gypsum	Agri-cultural Gypsum	Stucco* and Gauging Plaster	Wood Fiber	White§ Gauging	Sanded Plaster	Keene's Cement	Trowel Finish	Plaster Board— ½x32x36" Weight 1500 lb. Sq. Ft.	Wallboard, ½x32x36" Weight 1850 lb. Sq. Ft.	Lengths 6'-10', 1850 lb. Per M Sq. Ft.
Douglas, Ariz.....		6.00	6.00	13.00								
Fort Dodge, Iowa.....	3.00	3.50	6.00	8.00	10.00	10.50	20.00	21.30	20.00	20.00		30.00
Garbutt, N. Y.....			6.00	8.00	10.00	10.00		7.00			20.00	
Grand Rapids, Mich.....	3.00		5.00	10.00	10.00	10.00		31.00		19.75	20.00	30.00
Hanover, Mont.....	4.50		6.00	10.00		10.50						
Mound House, Nev.....		8.50	6.50	10.50@11.50								
Oakfield, N. Y.....	3.00	4.00	6.00	8.00	10.00	10.00	20.20	7.00+	30.75	21.00	19.375	30.00
Rapid City, S. D.....	4.00			10.00	11.00	11.50			33.75			
San Francisco, Calif.....				16.40								
Winnipeg, Man.....	5.50	5.50	7.00	13.50	15.00	15.00				28.50		35.00

NOTE—Returnable Jute Bags, 15c each, \$3.00 per ton; Paper Bags, \$1.00 per ton extra.

*Shipment in bulk 25c per ton less; †Bond plaster \$1.50 per ton additional; +Sanded Wood Fiber \$2.50 per ton additional; §White Moulding 50c per ton additional; ¶Bulk; (a) Includes sacks.

Traffic and Transportation

By EDWIN BROOKER
Munsey Building, Washington, D. C.

Proposed Changes in Rates

THE following are the latest proposed changes in freight rates up to the week beginning April 30:

Central Freight Association

6321. Sand and Gravel, from Macksville and Terre Haute, Ind., to Sullivan, Ill., present rate, 14 cents per 100 lb.; proposed rate, 98 cents per net ton.

6326. Crushed Stone, from McVitty's and France Quarries, Ohio, to the following stations. Present rates sixth class:

To	From McVitty's	From France Quarries
Delphos	\$.90	\$.95
Rushmore	.90	.95
Rimer	.90	.95
Jones City	.90	.95
Vaughansville	.80	.85
Columbus Grove	.80	.85
Pandora	.80	.85
Bluffton	.80	.85
Cordelia	.80	.85
Jenera	.80	.85
Arlington	.80	.85
Mt. Blanchard	.80	.85
Pratts	.80	.85
Sycamore	.80	.85
Plankton	.80	.85
Lykens	.80	.85
Chatfield	.80	.85
New Washington	.80	.85
North Auburn	.80	.85
Plymouth	.80	.85
Greenwich	.90	.90
New London	.90	.90
Spencer	.90	.90

6332. Sand and Gravel, from Couty Spur, Mich., to Michigan City, Ind., present rate 17 cents per 100 lb.; proposed rate, \$1.07 per net ton.

6352. Crushed Stone, from Fultonham and White Cottage, Ohio, to Kenova, W. Va., present rate, sixth class; proposed rate, \$1.50 per net ton.

6341. Molding Sand, Mishawaka, Ind., to Muskegon, Mich., present rate, 18½ cents per 100 lb.; proposed rate, \$1.76 per net ton.

6352. Crushed Stone, Fultonham and White Cottage, Ohio, to Kenova, W. Va., present, class rate; proposed, \$1.50 per net ton.

6361. Sand and Gravel, Germantown to St. Mary's, Ohio, present, \$1.10 per net ton; proposed, \$1.00 per net ton.

Illinois Freight Association

1495D. Cement, carloads, 8½ cents per 100 lb., from Chicago (Buffington) to Glen Ellyn, Ill.

1774. Sand and Gravel, carloads, minimum weight capacity of car \$1.06 per net ton from Grayville to Mt. Carmel, Ill., via I. C., Brown, Ill., and Southern.

1788. Sand and Gravel, carloads, current minimum weight, \$1.15 from Chillicothe, Ill., to La Harpe, Blandinsville, Sciota, and Good Hope; \$1.10 to Bushnell, New Philadelphia, Marietta, Seville, Smithfield and Cuba; \$1 to Canton, Re-walts, Breeds, Glasford, Mapleton, Farmdale Cruger, Secor, El Paso, Gridley, Meadows, and Chenoa; \$1.10 to Weston, Fairbury, Forrest and Chatsworth, and \$1.15 to Piper City, LaHogue, Gilman, Crescent City, and Watseka, Ill.

1792. Crushed Stone, carloads, minimum weight capacity of car, \$1.01 per net ton from Lehigh and Kankakee, Ill., and \$1.14 from Thornton, to Popes, Ill.

1800. Lime, carloads, to revise rates 15½ cents per 100 lb., from Mosher and Ste. Genevieve, Mo., to Paducah, Ky., versus rate of 11½ cents per 100 lb., from St. Louis, Mo., and points taking same rates to Paducah, Ky.

1185. Cement, Natural or Portland (building), C. L., from cement producing points in O. R. M. V. committee territory to local stations on the Mississippi Central, revise rates on basis of 5 cents higher than rates to junction points.

1204. Cement, Natural or Portland (building), C. L., from Mitchell, Ind., to destinations in the Mississippi Valley located on the G. & S. I. and E. H. Y. P. T. named in I. F. A. T. B. Tariff 108-J, same rates as applicable from Hannibal, Mo.

New England Freight Association

4506. Common Lime, hydrated, quick or slacked, from Danby, Proctor, Center Rutland, Cavendish, Leicester Jct., and N. H. Jct., Vt., to N. Y. C., L. I. D. & H., B. & A. stations, placing Rutland stations on parity with B. & A. and D. & H. Co. producing points.

4551. Lime, Lime Ridge, P. Q., to Cumberland Mills, Me., 16 cents. Reason: To make rates comparable with rates currently in effect for like distances on lines of other New England carriers.

4572. Stone, broken or crushed, from Westfield, Mass., to East Greenbush, E. Schodack, Goulds, Nassau, Stockport, Center, Stottville and Stuyvesant Falls, N. Y., \$1.60 per net ton, Valatie, No. Chatham and Kinderhook, N. Y., \$1.40 per net ton. Reason: To provide rates for new movement of traffic.

Southern Freight Association

9669. Sand and Gravel, C. L., min. wt. 90 per cent of marked capacity of car, from Tennessee river, Tenn., to points in Tennessee and Kentucky. Class N rates apply at present. Proposed rates: To Nortonville, Ky., \$1.30; Hopkinsville, Ky., and Humboldt, Tenn., \$1.20; Paris and Clarksville, Tenn., 90 cents per net ton, proposed rates made with relation to rates in effect from and to other points on the L. & N.

9688. Cement, Natural or Portland (building cement), from Memphis, Tenn., to Haleyville, Ala., present rate, 47½ cents per 100 lb. sixth class; proposed rate, 17 cents per 100 lb.

9709. Cement, Lime and Plaster, L. C. L., from Memphis, Tenn., to stations in Mississippi on the G. M. & N. north of the A. & V. Class rates apply at present. It is proposed to establish commodity rates on basis of 175 per cent of existing Class N rates. The proposed rates range from 24½ cents to Brownfield, Miss., to 30½ cents per 100 lb., to Newton, Miss.

9725. Gravel, C. L., from Columbus, Miss., to Memphis, Tenn., present rate, 11½ cents per 100 lb., or \$2.25 per ton of 2000 lb. Class O rate; proposed rate, \$1.20 per net ton.

9743. Stone, broken or crushed, C. L., from Hopkinsville, Ky., to DeGonia and Tennyson, Ind., from Quarry Switch, Ky. (near Hopkinsville), to Boonville, Ind. The present commodity rates were established to take care of temporary movement of stone for state work in the vicinity of Boonville, Ind., DeGonia and Tennyson, Ind. These rates do not reflect the usual basis for making rates from Hopkinsville to destinations in this territory, which is lowest combination. In order to restore the usual basis, it is proposed to cancel the rate of \$1.15 per net ton from Hopkinsville to DeGonia and Tennyson, and \$1.08 per net ton from Quarry Switch to Boonville, permitting combination rates to apply.

9768. Lime (calcium), phosphate of, in bulk, bags or barrels, C. L., min. wt. 30,000 lb., from Nashville, Tenn., to Memphis, Tenn., present rates 43 cents per 100 lb. sixth class; proposed rate, 30 cents per 100 lb.

9791. Cement, C. L., from Nashville, Tenn., to Ohio and Mississippi River crossings, Mississippi Valley common and junction points and local and intermediate stations. It is proposed to establish specific commodity rates from Nashville, Tenn., to destinations named in line with rate at present obtaining from Kosmosdale, Ky., Richard City, Tenn., and other cement manufacturing points. Present rates (where commodity rates are published and proposed rates to representative points are:

To	Present	Proposed
Union City, Tenn.	\$.015½	\$.013½
Paris, Tenn.	.13½	.12½
Milan, Tenn.	.14½	.13½
Dyersburg, Tenn.	.15½	.15½
Jackson, Tenn.	.15½	.13½
Corinth, Miss.	.15½	.15½
New Albany, Miss.	.17½	.17½
Greenville, Miss.	.19	.19

Winona, Miss.	.19
Aberdeen, Miss.	.19
West Point, Miss.	.19
Vicksburg, Miss.	.20
Jackson, Miss.	.20
Meridian, Miss.	.20
Brookhaven, Miss.	.20½
Laurel, Miss.	.20½
Mobile, Ala.	.20½
New Orleans, La.	.20½
Pasadena, Fla.	.20½
Cincinnati, Ohio	.15½
Louisville, Ky.	.12½
Owensboro, Ky.	.12½
Cairo, Ill.	.13½
Memphis, Tenn.	.15½
St. Louis, Mo.	.18
Burgin, Ky.	.15½
Clarksville, Tenn.	.10½
Enterprise, Miss.	.20
Frankfort, Ky.	.15½
Hopkinsville, Ky.	.12½
Lumberton, Miss.	.20½
Nicholasville, Ky.	.15½
Pascagoula, Miss.	.20½
Richmond, Ky.	.16
Versailles, Ky.	.15½

Texas-Louisiana Tariff Bureau

5202-TX. Sand, Gravel and Shells, C. L. rates on between points in Texas: Proposition from shippers to reduce current rates on Gravel, Sand and Shells, taken from streams and waters between points in Texas, 10 per cent. Shippers state proposed reduction would decrease number of inland gravel pits, conserve land and assist in the building of good roads.

Southwestern Freight Bureau

8175. Cement. To establish rate of 14½ cents per 100 lb. on cement, from Chanute, Humboldt, Iola and Mildred, Kans., to Aubrey, Bozwarth, Electric Park, Gypsy Switch, Parthena Park, Red Fork, Sapulpa, Walters Junction. Remarks: The Oklahoma Union is a common carrier, operating about 20 miles of standard gage track, from Tulsa, Okla., connecting with the M. K. & T. at Tulsa, and it is desired to establish to, from and between points on this line and interstate points, the same rates, minimum weight, rules, regulations, etc., as now in effect to, from and between common points in connection with other lines, and as generally in effect in connection with other short lines such as Oklahoma, Union Traction Co., etc.

8219. Cement. To establish rates on cement, carloads, min. wt. 50,000 lb. from Ada, Okla., to points on the W. F. & N. W., based on differential of 6½ cents under Iola, Kan., to Oklahoma points on the W. F. & N. W., Brinkman and south to Devol, Okla., inclusive, and differentials in varying degrees under Iola to all other points, with the exception of Woodward and Laverne to Forgan, inclusive, where the proposed rate is the same as from the Gas Belt, with the exception of Woodward, where it is ½ cent higher. Remarks: It is claimed that this change is necessary in order to place rates from Ada, Okla., to these W. F. & N. W. stations on a parity with rates from Iola, Kan., and Dewey, Okla., and also to place rates to points on the W. F. & N. W. on a parity with rates from the Gas Belt to Texas points.

8242. Chatts. To establish rate of 11½ cents per 100 lb. on Chatts, carloads, from Webb City, Joplin district to Waynoka, Okla. Remarks: The proposed rate is now in effect via one line and it is desired to establish same via other lines.

Trunk Line Association

11317. Gravel and Sand (other than blast, engine, foundry, glass, molding or silica), C. L. min. wt. 90 per cent of marked capacity of car, except when car is loaded to cubic or visible capacity, actual weight will apply, Forestport, N. Y., to Eagle Bay and Racquette Lake, N. Y., \$1.18 per net ton.

11318. Lime and ground limestone, C. L., min. wt. 30,000 lb. on lime and 50,000 lb. on ground limestone, Carpenterville, N. J., to Jersey City, Harrison, Franklin, Manuka Chunk, N. J., Mt. Bethel, Pa., and other points: lime, building, 9½ to 14 cents; lime, agricultural, chemical gas, glass, and land and ground limestone, 8 to 12½ cents per 100 lb.

New Machinery and Equipment

Roller Mill for Wet or Dry Material

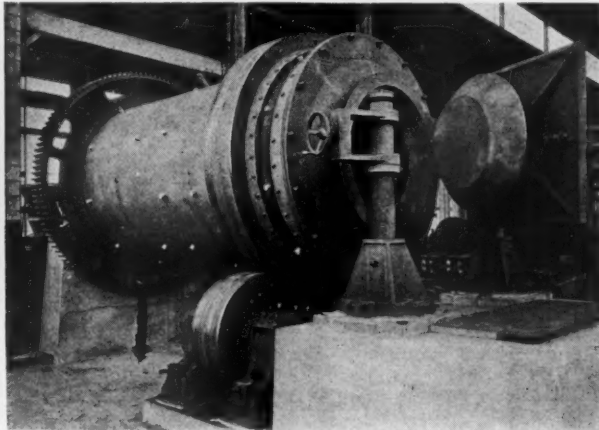
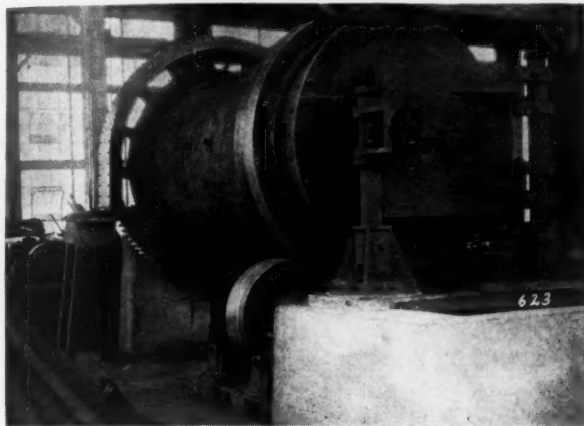
SINCE 1917 the Mine and Smelter Supply Co., New York City, has been experimenting with its roller mill, and today, says

the grinding medium is kept at a high point of efficiency, the manufacturers state.

The mill is claimed to be particularly efficient for dry grinding of lime, phosphate, cement, gypsum, crushed stone, glass sand, oil shale, talc, terra cotta materials.

Bucket with Strength and Reduced Weight

THIS bucket, say the manufacturers, the Mead-Morrison Co., East Boston, Mass., is designed to save the contractor the ex-



Two 6x12-ft. roller mills assembled and set up in the shops previous to shipment

the company, it has developed a rod mill of the highest efficiency.

This mill, with a 1-in. crusher feed, in one pass is claimed to produce a product of 8, 10, 14 or 20 mesh. Where finer grinding is desired the mill should be operated in closed circuit. This machine is especially desirable for regrinding work, and is an efficient grinding machine either wet or dry, it is claimed.

To get the best grinding results from rods there must be a heavy, slowly revolving rod mass, a low pulp line or a small amount of pulp, and a practical way to remove broken rods worn as small as $\frac{5}{8}$ in. The mill is made to meet these conditions. It is built along good engineering lines and particular attention has been given to its strength and wearing qualities. It has an open-end feature, by means of which a low pulp line is maintained and through which the rods can be removed and new ones easily replaced.

The low pulp line induces rapid removal of the finished product and permits carrying a thick pulp whereby the rods and liners are coated with particles of material which assist the contact that produces efficient grinding and greatly increases the capacity, since the rods work on thin layers of thick pulp. This mill does most of its grinding by attrition instead of by impact and therefore a grinding medium of low cost can be used. Because of the door feature at the discharge end, examination can always be made of the interior conditions, and thus

and for pulverizing coal. As in wet grinding, the Marcy low pulp line principle is designed for rapid removal of the product ground to the desired fineness, allowing the rods to work on coarse material, and thus greatly increasing the efficiency and the capacity of the mill.

These mills are in sizes having capacities from 20 to 1500 tons each per 24 hr.



This Type 12 grab bucket is designed to do digging or rehandling work

pense of doubling or trebling his investment in grab buckets to take care of different kinds of work. It is adapted to all kinds of materials suitable for clamshell.

This all-around ability of the bucket is achieved first by proper proportioning that gives strength with reduced weight; secondly, by a layout that insures the maximum application of power when it is most needed to close the bucket; and lastly, by use of the materials that are best suited to stand severe wear and tear on the respective parts.

The bit at closing is secured by off-center arrangements both at the hinge-shaft and at the pivots of the yoke and links. This gives a powerful leverage as the jaws come together. The characteristic action of the bucket, therefore, is not to lift but to stay where it drops and to dig down.

For different services the bucket is equipped with removable counterweights on the lever arm while the purchase at the sheaves may be changed to either two, three, four or five part arrangement.

The manufacturers' aim has been not only to give this bucket long life but reliability to keep it constantly on the job. The shell is bolted to the frame so it is renewable in the field, and every wearing part, including hinge-shaft bushings, is easily replaced without dismantling the bucket.

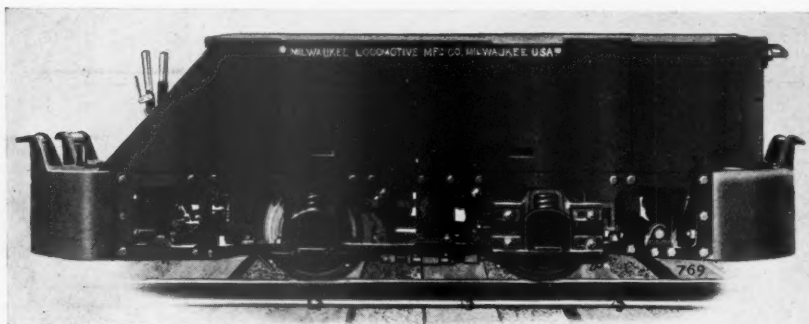
All features show the careful study and long experience—even the shape and overhang of the removable teeth have been determined by experiments on all materials.

New Six-Ton Four-Speed Gear-Drive Locomotive

THE Milwaukee Locomotive Mfg. Co., Milwaukee, Wis., has placed on the market a new six-ton four-speed gear-drive locomotive designated as "Type F-30." The locomotive in working order weighs 12,000 lb. It has four speeds ranging from $2\frac{3}{4}$ to 12 miles per hour at governed engine speed of 1000 r.p.m. at which rate 45 hp. is developed. In low gear, the locomotive has a drawbar pull of 2400 on suitable clean, dry rails. A chain drive is used from transmission to jackshaft, and

The four-speed transmission has wide-face gears which are always in mesh and operate in a bath of lubricant. All shafts and gears are made of S. A. E. specification steel, carefully heat-treated and hardened. The shafts are equipped with ball bearings, and speed changes are effected by means of jaw clutches.

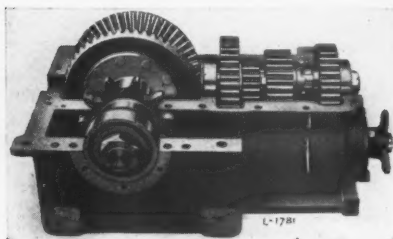
The engine radiator is of the sectional type with ample cooling capacity. It is designed to permit the removal of any one or more of the sections for repairs or replacement without detaching the radiator proper from the locomotive and is protected by a substantial guard.



Type L-30 six-ton gasoline locomotive with inside wheels and gear chain drive

from jackshaft to both axles, applying power to all four wheels.

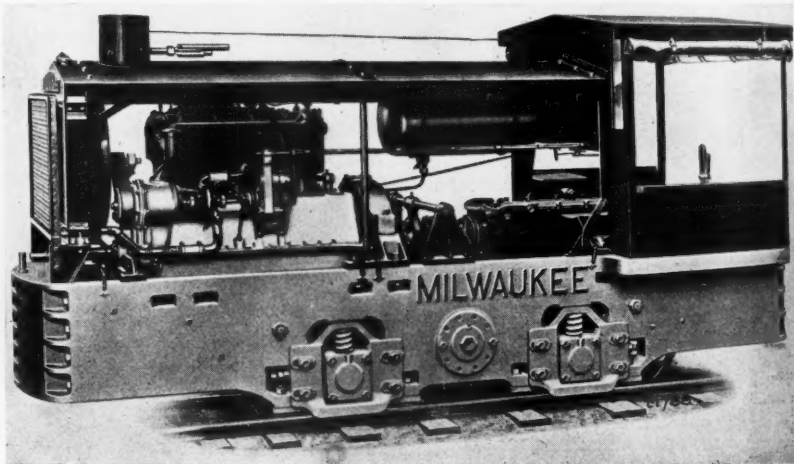
The wheels are cast iron with chilled treads 18 in. in diameter. The frame is of sturdy construction with cast-iron sides and cast steel bumpers. It is of ample strength and rigidity to take care of not only the weight and strain of the operat-



The four-speed transmission assembly with cover removed

ing mechanism, but to stand up under all ordinary derailments and collisions incidental to industrial operations, states the company. A simple and accurate adjustment is provided for all drive chains.

The gas engine used in the Type F locomotive are removable-head, having force-feed lubrication, and are equipped with maximum-speed regulating governor. The engines are furnished with magneto as standard equipment, but when electric starter and lights are specified, engines will be equipped with generator and starting motor as separate units. The engine has four cylinders and a cast-iron crankcase.



Type F-30 six-ton, four-speed drive locomotive with side covers removed, showing accessibility to working parts

A New Explosive

EXTENSIVE experimental work on a more extended use of Dumorite, the new explosive, has been made by E. I. du Pont de Nemours & Co. In working out the tests it was found that Dumorite gives excellent results as a top load in quarry shots in combination with a denser or more water-resisting explosive in the bottom of the hole. Where the hole is too wet, the rock too hard, or the burden on the toe too heavy for Dumorite alone, gelatin dynamite or Red Cross Extra, preferably the former, can frequently be loaded in the bottom with Dumorite on

top. Such a loading, claims the company, breaks clear to bottom with good fragmentation and does the work at considerably less cost than if gelatin or extra were used for the entire charge. If the holes are wet, the gelatin or Red Cross Extra should extend at the least up to the water line.

In well drill holes, the best method of firing is by the use of cordeau, running a strand of cordeau to the bottom of each hole, connecting the holes by a trunk line of cordeau and detonating all the holes together by a single electric blasting cap. If cordeau is not employed, two primers of gelatin or extra, should be used, one in the bottom load and the other in the Dumorite.

Data concerning such combination shots made during the last nine months is given herewith:

Shot No. 1—Location and loading: Limestone in solid formation. Ten well drill holes averaging 50 ft. deep, spaced 15 ft. center to center and 20 ft. back. Total loading, 1250 lb. duPont gelatin 60 per cent and 1550 lb. Dumorite No. 2, all cartridges 5x10 in. Tamping averaging 26 ft. Results: Very well spread and satisfactory to all interested in the shot.

Shot No. 2—Location and loading:

Limestone stratified formation. Four well drill holes 40 ft. deep, 15-ft. centers, 15 ft. back and 25 ft. toe. Loaded 100 lb. du Pont gelatin 60 per cent and 100 lb. Dumorite No. 2 in each hole, 5x16 in. cartridges, 3 to 15 ft. of water in holes. Actual loading took 1 hr. Results: Fragmentation good, and shot satisfactory to quarry owner—estimated $4\frac{1}{2}$ tons of stone thrown down per pound of explosives used.

Similar shots with Dumorite as a top load have been made in other quarries and in every case the customer has been well pleased with the results, says the company.

News of All the Industry

Incorporations

The Consumers Sand Co., Waterloo, Neb., has been incorporated for \$50,000 by T. Cone, C. F. Peterson and G. H. Gray.

The Superior Cast Stone Co., Grand Rapids, Mich., has been incorporated for \$10,000.

The Los Angeles Decomposed Granite Co. has been incorporated in Los Angeles, Calif., for \$60,000 by E. J. Skeans, S. E. McCallum and M. H. Pearson.

The Arlington Heights Gravel Co., Fort Worth, Texas, has been incorporated for \$5000 by C. R. Bachus, J. and F. D'Arcy.

The Kansas Sand Co., Topeka, Kans., has just been organized and will be incorporated for \$50,000. Otto Kuehne, Jr., is president. The plant will be located in the Kaw river.

The Glenn Sand Co., Tulsa, Okla., has been incorporated for \$50,000 by H. E. Bagby, G. B. Bagby and H. C. Fair, all of Tulsa.

The Central Roofing and Supply Co., Waco, Texas, has been incorporated for \$5000 by G. B. Rogers, E. S. Collier and G. H. Belew.

The American Crushed Rock Co., Los Angeles, Calif., has been incorporated for \$450,000.

The River Products Co., Iowa City, Iowa, has been incorporated for \$350,000 to operate limestone quarries. J. L. Records is president; L. C. W. Clearman, secretary, and S. Hands, manager.

The New York Roofing Supply Corp., Manhattan, N. Y., has been incorporated for \$10,000 by J. W. Faison, T. B. Breen and M. F. Neville.

The Tolu Fluorspar Co., Evansville, Ind., has filed articles for incorporation. The company will mine fluorspar in western Kentucky and southern Illinois and has been capitalized at \$50,000. Incorporators are J. D. Folz, Tolu Ky.; James F. Enslie and C. H. Parsons, Evansville.

The American Cement Plaster Co. of Wisconsin, Milwaukee, has been incorporated for \$25,000 by L. E. Stanton and others.

The New London Sand and Gravel Co., Willmar, Minn., has been incorporated for \$80,000 by H. L. Wadell and others.

The Mount Diablo Lime Marl Co., Walnut Creek, Calif., capitalized at \$100,000, has filed articles of incorporation and will conduct a general lime-quarrying business. G. A. Putnam, Walnut Creek; R. W. King and R. L. Frye, Oakland, are directors.

The Santiago Creek Rock and Gravel Co., Olive, Calif., has been incorporated for \$50,000. L. F. Baash, H. M. Dailey, Whittier; J. Renfro, L. H. Calderwood, Brea; and F. R. Dennison, Fullerton, are directors of the company.

The Clarke Rock and Gravel Corp., Los Angeles, Calif., has been incorporated for \$100,000.

The Funk-Rasmussen Co., La Crosse, Wis., has been incorporated for \$150,000 and is authorized to buy, sell, own, and operate stone quarries. Incorporators are E. A. Funk, A. J. Rasmussen and W. F. Funk.

The Glacier Sand and Gravel Co., Mitchell, S. D., has been incorporated for \$50,000 by W. C. Roberts, H. W. Hotchkiss and R. E. Heald.

The Beaver Valley Cement Products Co., Wilmington, Del., has been incorporated for \$400,000.

Cement

Pueblo, Colo.—The "Chiefton" for April 20 states: "Portland and Concrete have been jocularly referred to in this paper as western suburbs of Pueblo, but if the gradual advance of their operations keeps working this way it will be more of a reality than a joke. An immense new corporation has been formed, the Arkansas Valley Portland Cement Co., with capital stock of \$3,000,000, by residents of Florence and Denver. According to a telegram published in the 'Citizen' the company intends to locate a big plant 'east

of Concrete' which will employ 150 men. How far east of Concrete is an item of interest to Pueblo but is not stated. Concrete is about 25 miles up the creek."

The Oklahoma Portland Cement Co., Oklahoma City, Okla., has filed several petitions charging discriminatory freight rates before the State Corporation Commission. The Missouri, Kansas & Texas; the Fort Smith & Western; the Atchison, Topeka & Santa Fe, and the Kansas, Oklahoma & Gulf railroads were made defendants.

The Henry Cowell Lime and Cement Co. has added to its harbor equipment; also new machinery to its plants at Diablo and Santa Cruz.

The Monolith Plastic Waterproof Portland Cement Co., Los Angeles, Calif., is shipping large quantities of its material to Portland, Ore., the San Francisco Bay region and the San Joaquin Valley, in addition to southern California, for building construction. The company has established sales offices at Portland and San Francisco.

The Kansas Portland Cement Co., Kansas City, Mo., will operate the former plant of the Bonner Portland Cement Co., Bonner Springs, Kans., recently purchased by the International Portland Cement Co. Plans are nearing completion for enlargements in the works to develop an annual production of 4,000,000 bbl. and operations will soon be commenced. H. Struckmann is president.

The Olympic Portland Cement Co., Bellingham, Wash., shipped 3000 bbl. of cement to Bremerton recently. The company receives 10 cars of lime rock daily from Concrete, along with cars of rock from its Balfour quarries.

The Lime Co., Seattle, Wash., which owns a 672-acre deposit on Snake river, will play a large part in the power development at Priest rapids. H. J. Pierce, a director, is identified with the project and is said to be interested in plans of the Westinghouse Co. and the Chemical Products Co. for installing plants there.

The Newaygo Portland Cement Co., Newaygo, Mich., has increased its capital stock from \$945,000 to \$1,695,000.

The Southeastern Portland Cement Co., Macon, Ga., recently organized with a capital of \$6,000,000, will break ground within 60 days for its new cement mill to cost \$1,000,000 with equipment. A power plant will be constructed. W. Jordan Masse, well-known brick manufacturer, is president.

The Superior Portland Cement Co., Seattle, Wash., has made application for water appropriation for a large hydro-electric power project, to cost about \$175,000, on Jackman creek. Pipeline 2.37 miles long will be required; a diversion dam less than 10 ft. high and more than 50 ft. long will be installed. A static head of 680 ft. will be obtained with about 4250 hp.

The Linwood Cement Co., Davenport, Iowa, has begun a campaign to finance erection of a \$1,000,000 cement mill at Linwood. The company is capitalized at \$2,000,000 and a portion of this stock will be sold. Howard A. Klove is in charge of the securities department just created and has charge of the campaign.

The Chee Hsin Cement Co., Tientsin, China, has established a branch office at 76 Hsi Kiao Min Hsiang, Peking, China. Besides cement, the company sells bricks, pottery, etc.

Joe Clutts and others, it is rumored, will erect a 3000-bbl. cement plant north of Lyra, Scioto county, Ohio. Detroit and Chicago capitalists are said to be interested. The plant is to be located on the track of the D. T. & I. railway.

The Arizona Portland Cement Co., Phoenix, Ariz., has acquired 160 acres of land near Winkelman, as a site for a new mill to cost \$800,000, and will erect a power house, machine shop, pumping plant, etc. Loren C. Barton, Corporation building, Los Angeles, Calif., is assistant general manager in charge.

The Pittsburgh Plate Glass Co. has completed plans for new cement works at Zanesville, Ohio, adjoining its present limestone crushing plant. It will include a main building, 100x670 ft.; machine shop, 60x205 ft.; power house, and several other structures.

The Missouri Portland Cement Co., St. Louis, Mo., declared a quarterly dividend of 1½ per cent payable April 30 to stock of record April 20.

Claude H. Light, Garden Grove, Iowa, is reported to be organizing a cement manufacturing company at St. Joseph, Mo.

The International Portland Cement Co.'s net earnings for quarter ending March 31 are expected to approximate \$400,000 as compared with \$197,000 a year ago.

Gypsum

The American Cement Plaster Co., Cleveland, Ohio, has increased the wages of its employees. The amount was not stated.

The U. S. Gypsum Co., Cleveland, Ohio, has increased wages of its employees 5 cents an hour.

The American Gypsum Co., Port Clinton, Ohio, has increased its capital from \$200,000 to \$600,000. It has also increased wages of its employees; the amount not stated.

Sand and Gravel

The J. Eula Gravel Co. is erecting a gravel washing and screening plant at Delight, Ark. V. S. Watson is president.

The Campbell Gravel Co., Roscommon, Mich., has sold its operations to the Federal Sand and Gravel Co., Saginaw, Mich.

The Pioneer Sand and Gravel Co., Tacoma, Wash., will furnish the sand and gravel for paving the Pacific highway.

The Baker Gravel Co., Noblesville, Ind., has the contract to deliver gravel for the Range lime concrete road through Tipton and Hamilton counties, amounting to \$50,000.

The Missouri River Sand and Gravel Co., whose sand dredge recently snapped in two, will repair it and have it in working order shortly.

The Kirkpatrick Sand and Cement Co., Birmingham, Ala., will erect a warehouse to cost \$50,000.

The Louisiana Sand and Gravel Co.'s barge No. 2 has been launched in the Quachita river. It is equipped with a 250-hp. steam engine, 10-in. centrifugal pump, a marine boiler, and has a capacity of 200 tons per hour.

The Nicollet County's Gravel Pits, near St. Peter, Minn., will supply gravel for the improvement project of the Chicago & Northwestern railway in southern Minnesota and Iowa; \$170,000 worth of gravel will be used.

The Clear Lake Sand and Gravel Co., near Mason City, Iowa, will resume operations shortly.

The Columbia Gravel and Sand Co., Seymour, Ind., has been awarded the contract for 6000 tons of gravel to be used on roads in this district.

Quarries

The Jasper Stone Co., Jasper, Minn., has practically completed the installation of electrical quarry equipment costing \$25,000.

The Monmouth Stone Quarry Co., Monmouth, Ill., is planning to invest more capital to carry on its business. It will electrify its plant. The present output is 1000 tons a day, to be increased to 2000 when improvements have been made.

The Marion County Lime Co., Ocala, Fla., has under construction a complete mining plant with a capacity of 1200 tons of road material. J. Camp is secretary.

D. L. Feaster, Palmyra, Mo., has installed a lime crusher at Bragier, Mo., and a public demonstration was held and attended by more than 100 agriculturists.

The Mid-Coast Rock Co. at Sudden Ranch, near Santa Barbara, Calif., will soon be supplying crushed rock for street and building work. Machinery is being installed and a spur track laid

(Continued on page 64)

from the South Pacific. A. W. Belmont is general manager.

The Keystone Limestone Co., near Williamsport, Pa., owned by Pittsburgh interests, announces an increase of 10 per cent in wages.

The Edward Hely Stone Co., Cape Girardeau, Mo., broke all previous records in stone production in March, the output being 25,000 yd. Of this 240 cars were sold to concerns and the remainder went to railroads. Production this year is already over 50,000 tons.

The Natomas Co. will increase the output of its plant at Fair Oaks and Oraville, Calif., operated by the Coast Rock and Gravel Co., under a three-year lease. Business in 1922 was greater than in 1921, and prospects are good for an increased tonnage for 1923, most of which will be used by railroads for ballast.

The Vermont Marble Co.'s plant at Tokcen, Alaska, will operate all summer with 50 men, says E. H. Condon, superintendent. It is producing 7000 tons of marble annually; has been operating all winter.

The Amargosa Talc Co. began operations with the first gravity air separation plant on the coast, and are grinding an average of four tons an hour, or more than 6000 bags a week. The plant first ran through a quantity of mica, proving its efficiency and overcoming the usual difficulty of the laminated structure of this mineral. The raw product comes from Death Valley. R. W. Glendinning is general manager of this plant.

The Copps Reduction and Refining Co. has awarded the Hagner Construction Co., Appleton, Wis., the contract for a rock-crushing plant to be built at Randolph, Minn.

The Cherokee Marble Mills will construct a \$20,000 marble plant at Knoxville, Tenn.

The Halifax Rock Co., recently incorporated at Daytona, Fla., for \$100,000, has organized, with J. D. C. Morris, president; 150 acres are under development and the present output is 10 cars daily.

The Arkansas Lime Co., Ruddels, Ark., recently used 700 lb. of black powder and dynamite in one shot, bringing down 7000 tons of stone.

Smith Marshall, New Bedford, Mass., has been awarded the city's 1923 contract for crushed stone, which calls for 4000 tons each month. Price submitted was \$2.45 per ton.

The Woodbridge Trap Rock Co., Woodbridge, Conn., has been purchased by Bertolino Bros., who operate a small quarry adjoining it. The two plants will be combined. The consideration was about \$40,000.

The Limestone Quarries Co., Delphos, Ohio, recently taken over by the France Stone Co., Toledo, is making repairs to its machinery and will operate its plant all season.

The Connecticut Quarries Co., New Haven, Conn., has been preparing huge blasts at Reed's Gap, near Wallingford, to take place shortly, and will leave a tunnel in the mountains forming the letter "T" spreading 50 ft. either way.

The Porter & Adams Stone Crusher, near Plattsburgh, Mo., has an order for 500 cars of crushed stone. It is expected to operate the plant 24 hr. later on.

The Pacific Coast Paving Co., Dayton, Wash., has arranged with the Columbia county commissioners to install a rock crusher in McKay Hollow and crush 3000 cu. yd. of rock to be used on the McKay Hollow road. The rock will be furnished for \$1.35 per yard.

The Fort Smith Crushed Stone Co., Fort Smith, Ark., has begun operations and is turning out 100 cu. yd. of stone daily. The plant is owned by V. Forsgren.

Rutland, Vt.—A strike in the Seagreen slate belt covering Granville, N. Y., and Poultney and Fairhaven, Vt., which would have affected more than 2000 operatives, was averted. Ten cents more an hour in pay, making 60 cents, was demanded. A compromise was effected at 7 cents. Nine companies were involved.

The Blair Limestone Co., Millville, Md., announces it will enlarge its plant; also increase wages between 8 and 10 per cent.

The Ripon Limestone Co., Ripon, Wis., will furnish rock to be used by the Kramp Construction Co., on Highway 91 out of Ripon. The Kramp company has leased the steam shovel of the Lambert Construction Co. and moved it to the Ripon quarry.

The Spencer Stone Quarries, Spencer, S. D., has resumed operations after a shut-down of several months. Its first shipment of crushed stone goes to Lincoln, Neb.

The Sparta Quarry and Limestone Association has been formed by Sparta, Ill., interests to produce limestone rock and agricultural limestone.

The Lincoln Crushed Stone Co., Lincoln, Kans.,

has begun operations at its plant and will run full time.

The Monon Crushed Stone Co., Monon, Ind., has been awarded the contract for 10,000 tons of stone by the board of county commissioners to be used in road repairs. The price is \$1.88 per ton.

The Hancock Stone Co., Findlay, Ohio, has been bought by the Bluffton and Lewisburg Stone Co., Lima, Ohio.

The Amalgamated Sugar Co., Arco, Idaho, has started operations at its lime rock quarry. A long run is anticipated because of increased acreage of sugar beets in territory served by the company.

The Midwest Crushed Stone Co., Greencastle, Ind., will purchase land for quarrying valued at \$50,000, says President L. R. Cartwright. It has incorporated for \$60,000, of which \$40,000 will be preferred, to be used for expansion.

The Zenith Sand and Gravel Co., Carlton, Minn., is erecting a \$150,000 plant at Moose Lake with a capacity of 2500 yd. of washed material daily. The plant will be known as the Moose Lake Sand and Gravel Co. and be ready for operation shortly.

The Manhattan Sand Co., Manhattan, Kans., has been purchased by H. H. Allison, Salina, who has also purchased a half interest in the Concrete Stove Silo Co. The companies will also manufacture architectural trim stone.

The Oregon Gravel Co., Salem, Ore., has added a complete line of concrete building units. It is manufacturing concrete drain tile, sewer pipe, faced brick, etc. The company formerly dealt in gravel.

The Benton-Ball Gravel Co., Benton, Ark., will install gravel washing machinery at its plant. Electrical power will be furnished by the Arkansas Power Co.'s line.

The Burress Gravel Co., producers of Mansfield sandstone west of Shoals, Ind., is installing a washing plant. The plant is on the Baltimore and Ohio.

Lime

Seattle, Wash.—Washington lime will be used in construction of the new hospital at Camp Lewis as a result of the protest made by the Chamber of Commerce against the use of British Columbia material.

The Superior Lime and Hydrate Co., Pelham, Ala., recently organized, will begin constructing a plant with 15,000 bbl. capacity per month, to cost \$70,000, with machinery. H. C. Bridgewater and W. D. Lewis, Jr., Birmingham, are directors.

The Crystal Carbonate Lime Co., Elsberry, Mo., has tentative plans for rebuilding its plant recently destroyed by fire, with a loss of about \$65,000, including equipment.

The Krippendorf-Tuttle White Cliffs Product Co., a \$1,000,000 corporation formed by Cincinnati capital, will operate the limestone quarry at White Cliffs, near Nashville, Tenn. It is estimated the deposit contains some 400,000,000 tons of lime. The plant will have modern equipment, and when completed, 20 men can operate it at 50-carload capacity per day.

The New England Lime Co., West Stockbridge, Mass., has purchased a truck for taking employees to the Rockdale plant.

The Builders' Lime and Cement Co., Davenport, Iowa, has awarded the contract for the erection of a \$100,000 warehouse for the storage of lime and cement to the Priester Construction Co.

W. L. Brown, Gravette, Ark., is interesting local and outside capital in the re-establishment of the lime plant at Lime Kiln farm.

The Western Lime and Cement Co., Milwaukee, Wis., will build a two-story 70x82 ft. lime plant.

The Kelley Island Lime and Transport Co., Cleveland, Ohio, will build an addition to its Buffalo, N. Y., lime plant on the Buffalo river to cost \$30,000.

The Toledo Plaster and Supply Co., Woodville, Ohio, has doubled its capacity by adding 16 kilns and a hydrating plant, and has begun operations.

The Mission Lime, Marl and Compost Co., San Francisco, Calif., will begin operations as soon as the weather permits. The bunkers at Irvington are already partially erected. It is understood that the Consumers Lime and Dolomite Co. has been amalgamated with the former company.

Agstone

James Lawrence, county farm agent, Fairland, Okla., announces the second carload of lime from Tulsa will arrive for distribution among farmers.

The Committee on Limestone of the Farm Bureau, at a recent meeting at Canton, Ill., decided to order limestone for various places in Fulton county for bureau members.

The Mercer Farm Bureau, at its meeting, endorsed the project presented by farmers around Aledo, Ill., to prepare storage bins for holding lime and phosphate. A portion of bin space along the Rock Island Southern railway will be leased and used for this purpose.

Lawrence Peterson, Albion, Wis., has secured a contract for 1000 tons of ground limestone to be used by farmers in increasing alfalfa acreage. He has a portable outfit which he will move to various communities where limestone deposits are available.

Stillwater, Minn.—Farmers near Withrow have grouped orders for three carloads of ground limestone to be shipped at once, costing \$1.50 per ton, carload lots, f.o.b. loading point. The material will be used on alfalfa fields.

Jackson, Ohio.—Scioto farmers have organized a company to build a lime storage bin at Cove for community use.

Ralph L. Eyman, county agent, Jerseyville, Ill., attended the limestone conference at East St. Louis, held in the interest of Illinois farmers. A study of limestone, the ability of the railroad and limestone companies to deliver materials were the object of the meeting. According to Mr. Eyman, price of limestone will not decrease the next two or three years, due to labor situation and high freight rates. Price of limestone at present is from \$1.90 to \$2 laid down.

Magnesite

The General Magnesite and Magnesia Co., Philadelphia, Pa., has purchased a 4½-ft. x 16-in. Harding conical ball mill which will be installed in the near future.

Silica Sand

The Maryland Glass Sand Co., Hagerstown, Md., has increased its capital stock to \$250,000.

The Pennsylvania Glass Sand Co. plant near Hancock, Pa., has resumed operations after a strike lasting several days. The workers demanded a \$1 a day increase. Under the new agreement they will receive 35 cents an hour minimum, most of them receiving 45 cents. Other concerns in this district will probably follow. Scarcity of labor is responsible for the increase. All the local glass sand plants are working full force.

The Bellrose Standard Silica Sand Co., South Ottawa, Ill., recently had a fire in its boilerroom caused by overheated pipelines. Quick work on the part of employees saved the plant from destruction.

The Silica Products Co., Guion, Ark., contemplates installation of hydraulic equipment and will use water under high pressure to mine sand from quarry face.

Concrete Products

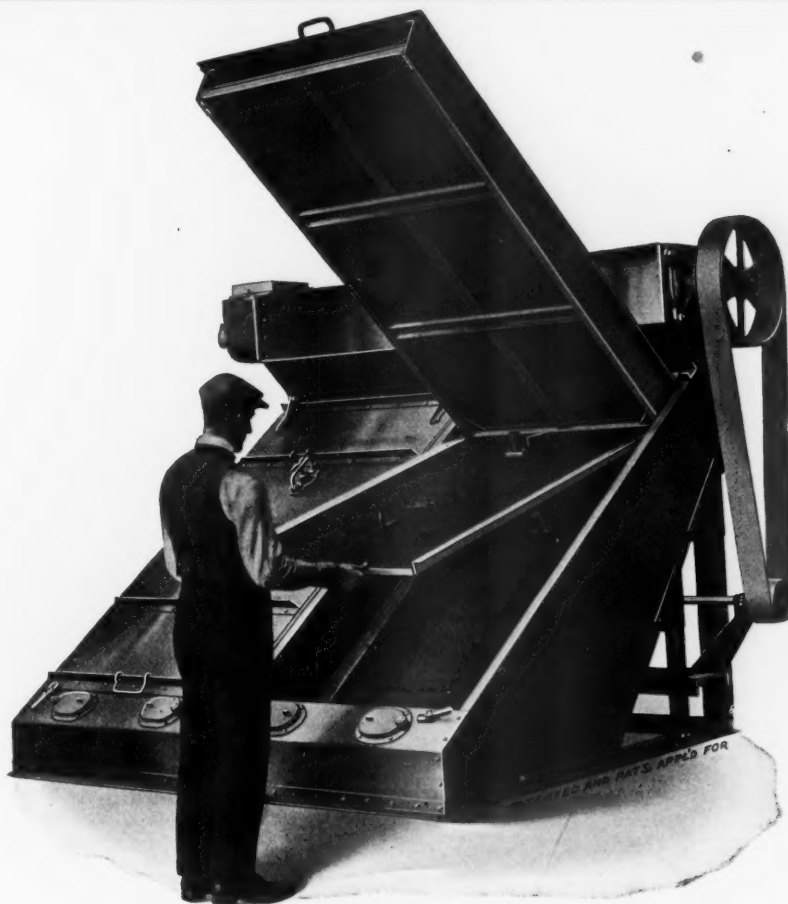
The Economy Concrete Co., Inc., Richmond, Va., with a capital of \$100,000, has acquired about five acres to erect a plant to manufacture concrete products, estimated to cost \$65,000. J. S. Parrish is president.

The Concrete Pipe Co., Inc., has established a plant in New Orleans, La. Col. C. L. Dulin is vice-president and manager.

The Leeds Concrete Products Co., Leeds, Ala.,

(Continued on page 66)

STURTEVANT



MOTO-VIBRO SCREEN

Has **STINGING**, Evenly Distributed **VIBRATION**

No Motor Generator—No Complications—No Auxiliaries—No Adjustments—No Dead Areas—No Dangerous Wire Stretching—No Destructive Flexing

1800 VIBRATIONS PER MINUTE

Simple, Durable, Accessible Unit Construction—Screens Anything Screenable, Coarse or Fine
SELF CONTAINED—ELECTRICALLY OR BELT OPERATED

40 Years of Screening Experience Back of It

SOLD ON TRIAL AGAINST ANY COMPETITOR

Let the Best Screen Win

PRICE ABOUT ONE-HALF THAT OF OTHERS

STURTEVANT MILL CO. HARRISON SQUARE **Boston, Mass.**

When writing advertisers please mention ROCK PRODUCTS

will soon be ready for the manufacture of brick, tile and sewer pipe.

The Galien Concrete Tile Co., Galien, Mich., has increased its capital stock from \$5000 to \$20,000.

The Reddog Products Corp., Bessemer building, Pittsburgh, Pa., will erect a plant costing more than \$75,000 with machinery.

The East Side Coal and Supply Co., Altoona, Pa., will erect a plant for manufacture of concrete products.

The Concrete Products Co., Houston, Texas, has completed installation of its trim-stone plant and is operating at practically full capacity. The company now has three plants.

The Concrete Building Tile Corp., Mt. Kisco, N. Y., has been incorporated for \$100,000 by G. C. Hoffman, Mt. Kisco.

The Concrete Products Co., Wheeling, W. Va., has been granted permission to lay a railroad switch from Pennsylvania lines to its plant at Warwood.

The Bemidji Concrete Mfg. Co., Bemidji, Minn., will start operating its plant in anticipation of a busy season, possibly using two shifts.

The Acme Brick Co., Malvern, Ark., has begun work on an annex to its plant to cost \$50,000. When the new section is finished, yearly production will exceed 24,000,000 brick. A rotary kiln will also be a new addition.

The Massey Concrete Products Co., West Montgomery, Ala., has completed its \$75,000 plant and is ready to manufacture concrete pipes and tiling. N. S. McGaffney is local manager with headquarters at Atlanta, Ga.

The Faulkner Reinforced Concrete Co., through the tariff bureau of the Hattiesburg, Miss., Chamber of Commerce, has succeeded in obtaining a reduction in freight rates, effective May 1, on concrete roofing tile not to exceed 15½ per cent of the first-class commodity rate, from the Mississippi Railroad Commission.

The Fornercrete Aggregate Co., Oakland, Calif., manufactures a non-lading material for buildings, artificial stone, floor tile, etc. C. K. Forner is director.

Phosphate Rock

Wilbur A. Nelson, state geologist of Tennessee, announces the geological department is preparing to make a detailed and exhaustive report on the phosphate beds of the state, and plans for a complete survey have been completed.

The Anderson Phosphate and Oil Co., Anderson, S. C., probably will liquidate its affairs, it has been announced by W. H. P. Sheppard, after a meeting of officials and creditors of the company.

The Seminole Phosphate Co., Goldsboro, N. C., a \$1,000,000 fertilizer company, has been placed in temporary receivership following action alleging insolvency.

The Washoe Reduction Works, Anaconda, Mont., has begun work on its fertilizer department, increasing it to 2½ times its present size. Manufacture of the fertilizer was first begun by the Anaconda Copper Mining Co. The present plant has a daily capacity of 120,000 lb.; with the new unit it will be increased to 300,000 lb. The cost will probably amount to \$400,000.

Feldspar

The Gloversville Feldspar Co., Gloversville, N. Y., has purchased from the Hardinge Co. a 6-ft. x 22-in. pebble mill.

Dealers

The John M. Hallare Co., Inc., has been incorporated for \$25,000 at Brooklyn, N. Y., by J. M. Hallare, M. E. Hallare and W. E. Hallare.

The Wall Builders' Supply Corp. has been incorporated for \$10,000 at Buffalo, N. Y., to deal

in cement, lime, gypsum products, etc., by M. C. Wall, E. Yeager, and F. Yeager.

The Louisville Building Supply Co., Louisville, Ky., has increased its stock from \$30,000 to \$150,000.

The Wm. P. Ternes Co., builders' supplies, Detroit, Mich., has been incorporated for \$500,000.

The Virginia Building Material Co., Richmond, Va., has been incorporated for \$25,000 at Richmond, Ind. L. C. Tolson is president and L. M. Lee is secretary.

W. D. Blanks & Co., Clarksville, Va., has incorporated for \$25,000 to handle building materials. F. A. Burton is president and C. W. Blanks is secretary.

The John Bollin Co., Inc., Detroit, Mich., has been chartered for \$25,000 to deal in building materials.

The Grand Rapids Builders' Supply Co., Grand Rapids, Mich., has increased its stock from \$25,000 to \$75,000.

The American Oolitic Stone Co., an Ohio corporation, has been incorporated in Indiana for \$250,000 to deal in stone and other building materials. P. C. Hain, Bloomington, Ind., is agent.

The C. D. Donato Cut Stone Co., Bedford, Ind., has been incorporated for \$100,000 to manufacture stone for building purposes, by C. D. Donato, M. Donato and J. A. Petro.

The Beverly Building Materials Co., Beverly Hills, Calif., has been incorporated for \$50,000.

The Standard Supply Co., Alameda, Calif., has been incorporated for \$250,000 by F. G. Coxhead, J. T. Revas, Jr., F. E. Seecley and others.

Personal

Dr. Oliver Bowles, mineral technologist of the Bureau of Mines, will read a paper on "Lime Evrning—The Economization of Fuel" at the annual conference of the Institution of Quarry Managers of Great Britain at Llandudno, North Wales, in June.

E. L. Osborne, formerly sales manager of the Ladd Lime and Stone Co., Cartersville, Ga., has opened an office in Atlanta, Ga., 1501 Citizens and Southern building, to handle products of the Knoxville Sand and Lime Co., Knoxville, Tenn., and the Kelley Island Lime and Transport Co., Cleveland, Ohio.

Harold H. Perry, manager's assistant, Industrial Works, Bay City, Mich., sailed April 28 for England to make an extensive study of locomotive and wrecking cranes as used in that country.

N. S. Potter, Jr., has been elected president of the Michigan Portland Cement Co., Chelsea, Mich., to fill the position formerly held by N. P. Potter, deceased.

A. E. Wilkinson, Lyscoming county superintendent of the state highway department for a number of years, has accepted the position as superintendent of the Susquehanna Stone Co.'s quarries at Dalmatia, Pa.

John C. Eden, president, Superior Portland Cement Co., Seattle, Wash., has returned from a three months' trip to Europe. He states the cement industry did 30 per cent more business during the first three months this year than last year, and believes this will be the biggest year in the history of the cement industry.

Manufacturers

The Gifford-Wood Co., engineers, founders, machinists and manufacturers of elevating and conveying machinery, have announced the removal of their Buffalo, N. Y., office to Pittsburgh, Pa., and their new address is the Peoples Bank building, corner of Fourth avenue and Wood street. This change has been made in the interest of better service to the firm's customers.

The Wheeling Steel Products Co. (sales company for the LaBelle Iron Works, Whitaker-Glessner Co., and Wheeling Steel and Iron Co.), discontinues May 1, 1923, and the Wheeling Steel Corp. will handle all sales and operations. The company will assume all existing sales obligations of the four companies. This action will not affect the personnel of the sales division, which will remain unchanged at Wheeling and at district sales offices.

Trade Literature

Lubricated Caterpillar Type Mounting—Just off the press is the new bulletin, No. 5-60, of the Erie Steam Shovel Co., Erie, Pa. This bulletin deals largely with the company's caterpillar type mounting, taking up in particular detail its lubricating system and the bushing of the link-pin bearings. Illustrated descriptions of some of the features of this mounting make it easy for the reader to understand the claims set forth by the company as to what economies and performances may be expected from the machine.

"Practical Facts About Belting" is a publication bound in loose-leaf form being distributed by the Charles A. Schieren Co., New York. It is a practical manual on belting and power transmission for engineers, plant executives, production managers, maintenance men, superintendents, foremen, etc. It is based on the company's long experience in belting and transmission engineering and was compiled by R. C. Moore, secretary and chief engineer, and considered an authority on the subject. It includes a discussion of the types of drives; facts such as belting rules and ratings, horsepower ratings, care and operation, proper methods for joining the ends of belts, alignment of drives; moist conditions and effective means for overcoming them; V and round belting; comparative operating cost of leather belting and substitutes; selecting the right belt for the drive; data on how leather belting is made; plant layout showing the most economical arrangement of drives; proper sizes and arrangement of shafting; and location of the motors. The book was originally planned in 12 sections but its success has been so marked that its publication has been extended to 18 sections to cover the additional subjects of belt problems and remedies for them, tables for the application of belt brands to suited drives; and a thorough study of leather packings. When completed this book will form practically the only complete work of its kind in circulation, affirms the company. It will be mailed free on request.

Centrifugal Acid Pump—The new lead pump catalog 7-C of the Schutte & Koerting Co., Philadelphia, just off the press, gives some interesting information concerning vertical and horizontal centrifugal pumps for handling chemical solutions. This pump can be submerged in the liquid it handles or can be located outside the tank below the liquid level. The construction is said to eliminate stuffing-boxes and other troublesome parts. The driving mechanism is placed at the top of a vertical shaft and is not affected by the liquid to be pumped.

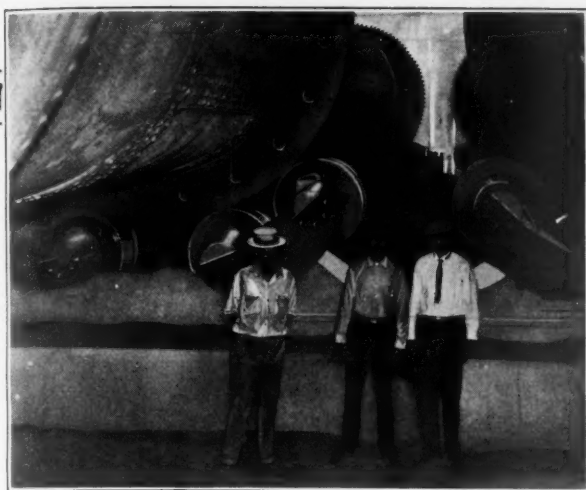
Babbitt Metals Textbook

TO many men in the various branches of business in which machinery plays a part, the selection of the right sort of babbitt metal for their plant bearings is a recurring puzzle. Babbitt is just babbitt to lots of people.

A little "textbook" briefly explaining what babbitt is, and how one kind is better for a particular job than another, has been placed within the reach of the industries by the Ajax Metal Co. of Philadelphia. It is the nature of the work to be done by a machine and the conditions to which its bearings are subjected which determine the kind to be used.

Certain combinations of metals produce hardness and compressive strength; others produce a more plastic, yielding alloy, and hence these metals may be classified as tin base, intermediate, and lead base metals. Their uses are made plain to the reader and their limitations and requirements explained; grades and types of babbitts are also treated.

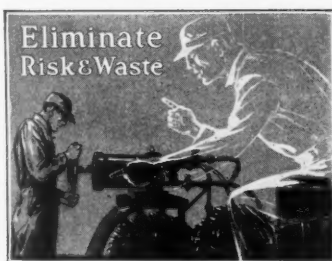
The book also contains short treatises on composition, the right method of re-babbitting, six points to remember when pouring, common errors in selecting a metal, and a number of illustrations punctuating the application of this metal. The book is well worth careful study.



A section of the Kiln Room, taken from the extreme hot end of the Kilns and showing the first line of bearings

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Efficient lubrication of various types of machinery required to operate under abnormally high radiated heat conditions has long been a problem to plant executives.



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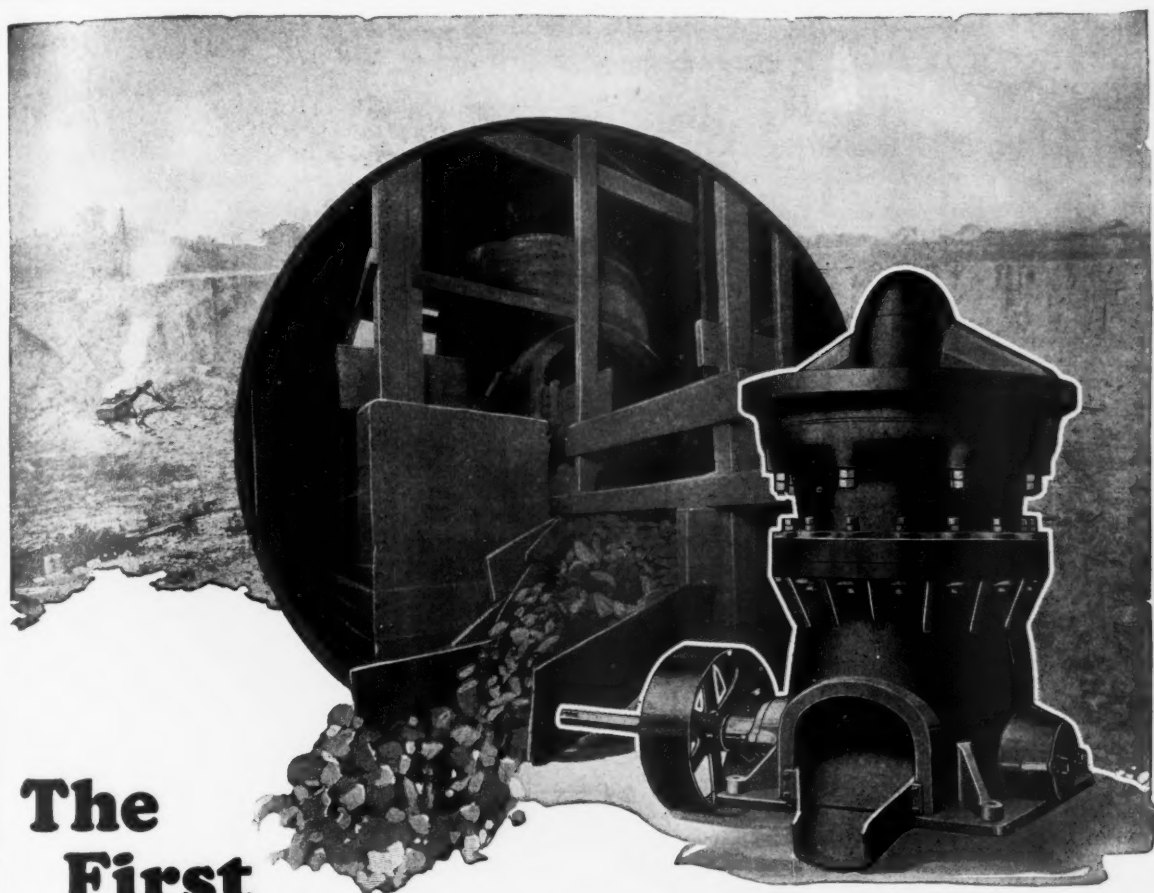
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And that's only one of the reasons why Milwaukee Gasoline Locomotives are being so generally adopted in the quarry and general industrial field.

There's a type and size for every class of haulage, and each and every one is sold on a positive guarantee based on actual performance.

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Publication O-121 tells all about them. Write for a copy to-day—NOW!

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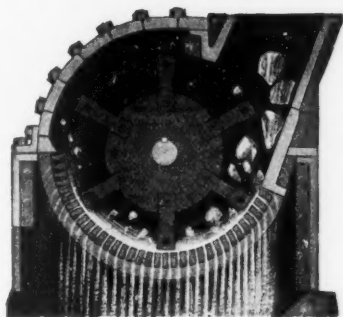
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It Is Cheaper to Make Your Own Screenings for Road Contracting Work Than to Buy Them



Type "A" Swing Hammer Pulverizer



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Jeffrey Equipment also includes:

Elevators	Portable Loaders
Conveyors	Portable Belt
Chains	Conveyors
Buckets	Electric Trolley and
Sprockets	Storage Battery
	Locomotives

THERE is certain to be, at times, a considerable difficulty in getting a sufficient percentage of fine screenings from the average crushing outfit.

A Small Jeffrey Type "A" Swing Hammer Pulverizer

Is Just the Machine to Install for Doing This Work

This pulverizer gives an excellent product of binder material for water-bound roads, top dressing or filler that will meet the rigid demands of the state or county highway department. It can also be used for some grades of concrete work.

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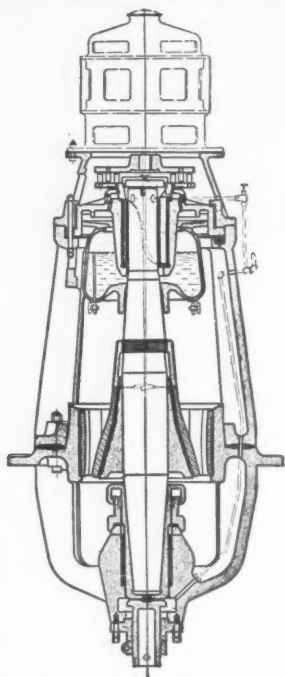
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It has a capacity of from 3 to 5 times greater than geared gyratories with less power consumption in proportion. Speed of gyrations 3 to 4 times higher than geared crushers, making it possible to crush a rock and its parts four times as it falls through. Finishes 90 per cent of rejects on closing side.

Gears, Countershafts and Belts are eliminated. Eccentric is at the top, is Bronze Bushed and Oil Floated.

Dust in oil supply and bearings absolutely prevented. Lubrication is positive without pumps. Accurate tests on No. 36-A shows a gallon of oil per minute flowing through main eccentric bearing.

All parts accessible to overhead crane. Crushers may be completely dismantled or assembled in one hour.

Construction is all steel with Chrome-Vanadium Molybdenum forged steel shaft. Built in six standard sizes—largest size takes 12 in. rock rejecting 350-450 tons per hour. Smallest machine when set to 1 3/4 in. rejects 120 tons per hour, or 40 tons per hour with 1/2 in. setting. Arranged for both motor and belt drive.

Send for Bulletin 25 Which Describes This Machine in Detail

The Morgan Engineering Company

ALLIANCE, OHIO

Pittsburgh
1420 Oliver Bldg.

Designers, Manufacturers and Contractors
Electric Traveling Cranes, Rolling Mill Machinery
Ordnance, Steel, Shipbuilding and Forging Plants Complete, Rock Crushers, Special Machinery for Any Purpose

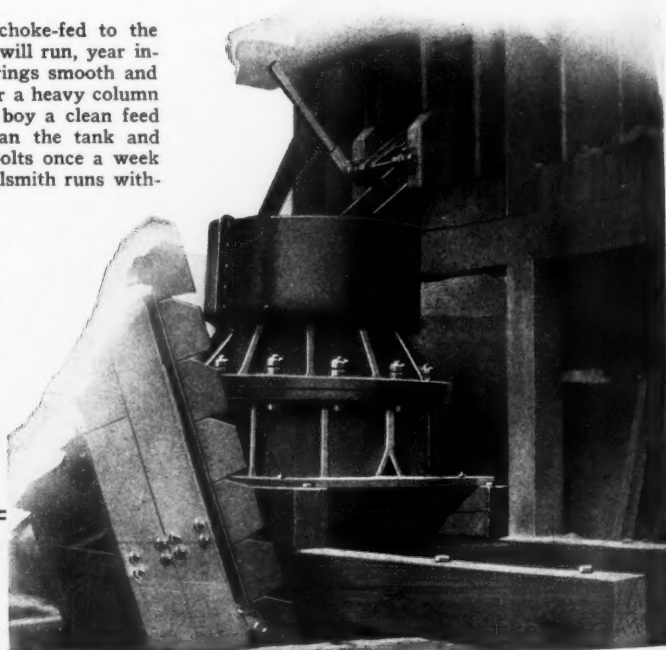
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TELSMITH—THE No-Worry RE-CRUSHER

We know of only one re-crusher that can be choke-fed to the nozzle all the time, with absolute assurance that it will run, year in-year out, with the bolts tight, the oil cool, the bearings smooth and shiny. TelSmith asks no mercy. It works best under a heavy column of rock. Only this we ask—that you give the old boy a clean feed of economical size, free from fines; that you clean the tank and change the oil regularly; that you tighten up the bolts once a week and read the oil temperature hourly. Otherwise, TelSmith runs without supervision.

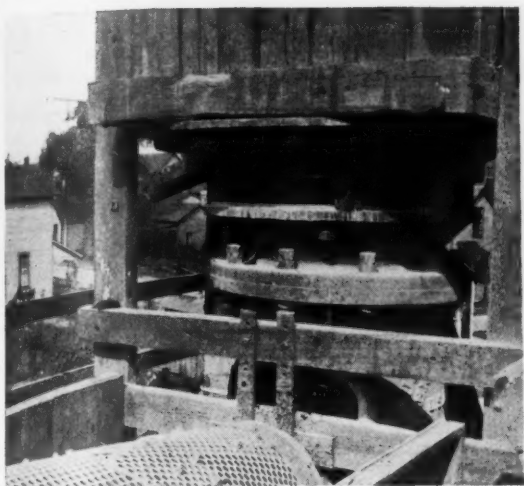
Don't worry about tramp iron. The upper and lower frames are cast steel, walled and ribbed to withstand enormous shocks. The main shaft is a short thick bolt of high-carbon steel. These vital parts are guaranteed against breakage, even by tramp iron. This is one machine that, once installed, you can almost forget.

Glad to send you, without obligation, our Bulletin No. 2F11 (TelSmith Reduction Crusher) and Catalog No. 166 (TelSmith Primary Breaker).



Smith Engineering Works
3188 Locust Street Milwaukee, Wis.

Canadian Representatives:
Canadian Ingersoll-Rand Co., Montreal, P. Q.



Making Little Ones Out of Big Ones

This time-honored occupation is not the hard job it is cracked up to be, if left to an AUSTIN GYRATORY CRUSHER. Instead, the contractor or public official has the assurance of an ample supply of stone at all times, and the knowledge that time, labor and expense are being saved, as well.

Catalog 29-T gives many reasons for the greater all-around efficiency of Austin-equipped plants. We will gladly mail you a copy.

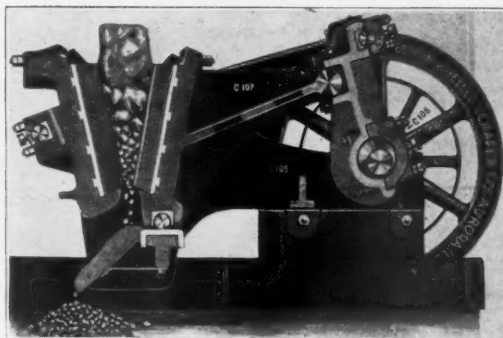


AUSTIN MANUFACTURING CO.

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Chicago

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WESTERN - AURORA

The Jaw Crusher That is Different

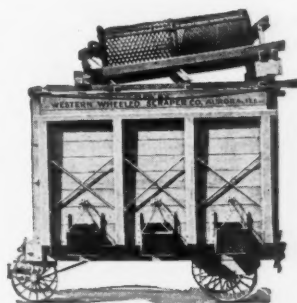
Different in design. Look at the sectional view. Not a time-wasting spring to break, or toggle to fall out.

Also—and what is even more important—a continuous double-stroke crushing motion which increases capacity, reduces vibration and economizes power.

The Western-Aurora Crusher is different in many ways that serve to speed up the work and fatten your pocketbook; and other units of the complete crushing and screening plant are on a par with it. Elevator, screen and bin—all are of the most substantial construction.

A Western-Aurora Crushing Plant is a mighty fine investment from every angle.

Other reasons are found in Catalog 44-T. We would like to send you a copy

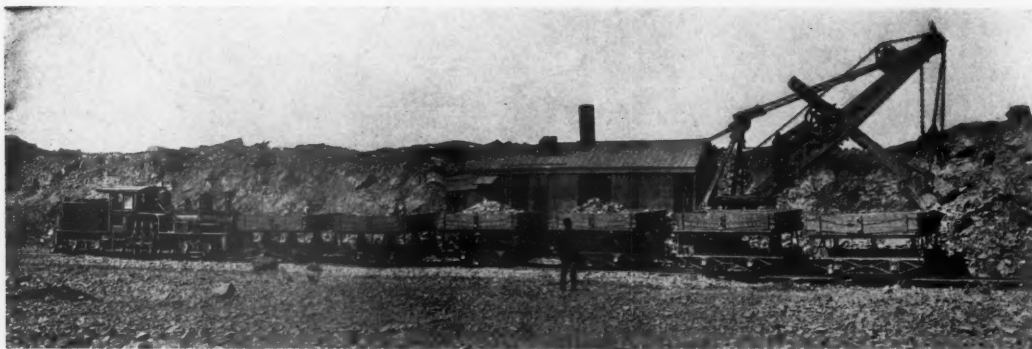


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Chicago, Illinois

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"Everything from a Drag Scraper to a Road Roller"



Seventeen Years' Experience With Shays



The Shay Industrial Catalog will tell you more about the Shay. Write for copy.

"We have been using Shay Locomotives for the last seventeen years and have found them perfectly satisfactory in every way. I don't think any but a Shay would have given the satisfaction which we have enjoyed."

High grade materials and rugged

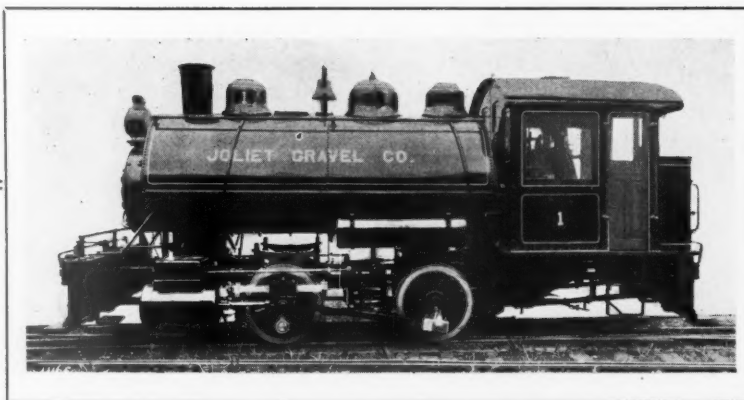
construction, plus proper design, enable the Shay Geared Locomotive to stand up under years of hard service.

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LIMA LOCOMOTIVE WORKS, Incorporated

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VULCAN LOCOMOTIVES

Cuts Down the Haulage Time

The efficient tool of modern quarry operation is a Vulcan Locomotive.

When the Vulcan moves in, sloth and extravagance move out. It is built to

stand up and take the buffets of an uneven road, and without a falter, to deliver its full power in rough and ready service with clocklike regularity and with utter dependability regardless of conditions.

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U. S. PATENT OFFICE

Koppel Hinged Type Square Box Dump Cars



*For Quarry Service and
Steam Shovel Loading*

The large door opening—the substantial door construction—the pressed steel diaphragms in the underframe—the double spring suspended bearings are some of the features which make these cars operate easily, ride the track smoothly and stand up under the strain of steam shovel service.

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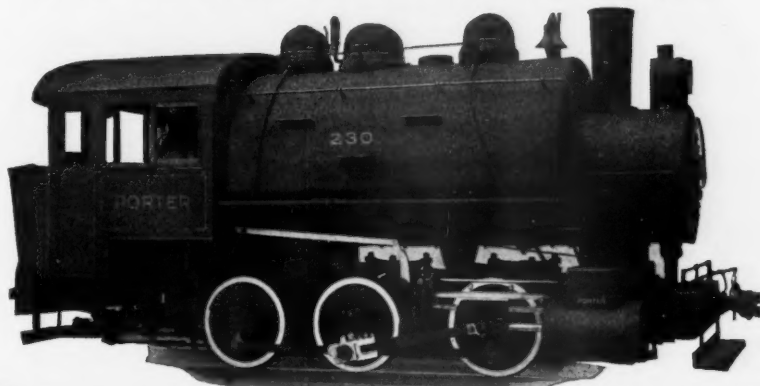
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If you need a Locomotive at all—because it has been, for over a half century, the best engine made for Contractor's work. Let us make suggestions for your use.

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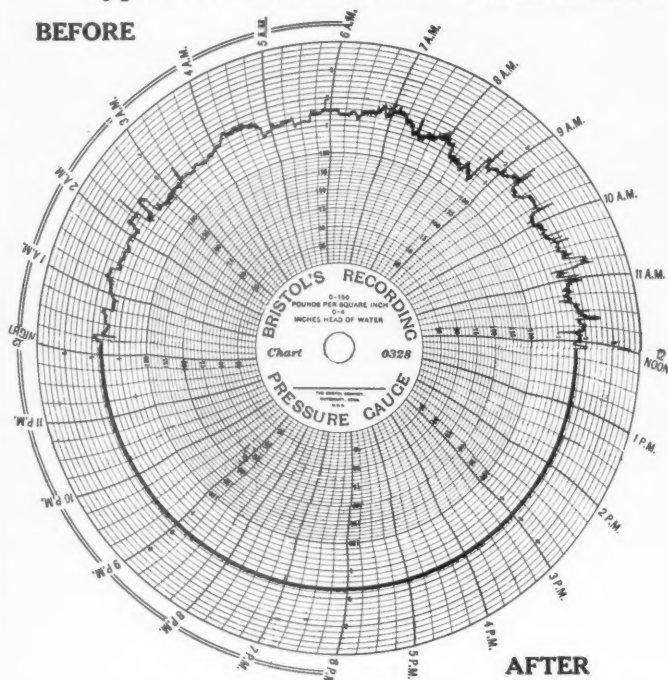


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Typical Chart Record of Producer Gas Pressure With and Without the

BEFORE



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Producer gas cannot be burned efficiently and economically in any furnace when the gas main pressure is irregular as shown by upper half of chart.

Since the supply of atmospheric air entering any furnace is under constant **PRESSURE**, in order to maintain a uniform temperature, the **gas** also must be under **CONSTANT PRESSURE**. Consequently, any type of furnace using producer gas regulated with a Chowning Regulator fulfills this requirement.

Any furnace burning producer gas so controlled not only uses 3½% to 8% less fuel but **PRODUCES FASTER** and with **LESS** furnace repair. The initial cost completely installed is recovered within from 3 to 6 months.

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Blast in an Ohio stone quarry consisting of one hundred and fifty-six well drill holes each approximately twenty-six feet deep.

Cordeau-Bickford was used to detonate the explosive charge. A power line installation would be necessary to detonate this shot with electric exploders.

Cordeau-Bickford is particularly adapted for detonating a large number of explosive charges thoroughly and instantaneously.

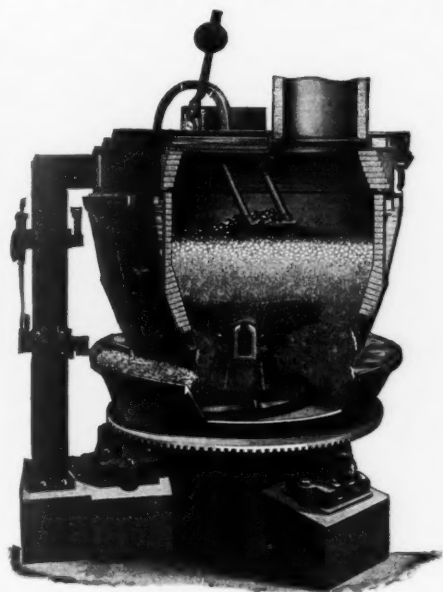
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Established 1836

Original Makers of Safety Fuse

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Selected by every large purchaser in the steel industry since the armistice. Three recent installations at leading Eastern Lime Plants.

POKERLESS PRODUCER-GAS MACHINE

Users everywhere testify with one voice to the superior satisfaction and low maintenance expense of this splendid machine. Difference in first cost comes back annually; every detail built for endurance.

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W. D. Mount, 601 Peoples National Bank Bldg., Lynchburg, Va., Representative in the Lime Industry

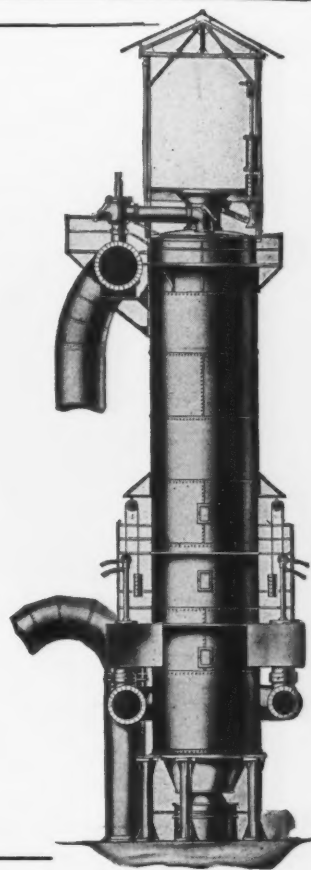
Continuous Discharge—Gas Fired LIME KILNS

The wastefulness of efficiency of any lime burning apparatus is determined by the amount of fuel per ton of lime produced.

Our Kilns are not an experiment, but have successfully met the test of years of actual service. The design is the work of our Consulting Mechanical and Chemical Engineer, who has had many years of practical operative experience. They embody a number of labor saving devices, and are designed to secure maximum production with minimum fuel consumption; their record in this respect should interest every lime producer in the country.

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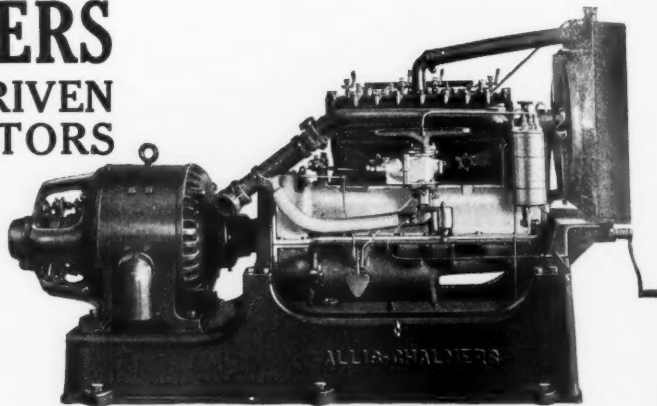
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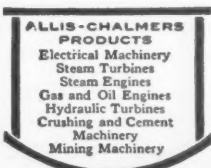
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Cycles, 50 to 125 K. W.

These sets are self-contained. They can
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15 K. W., 125 Volt Direct Current Set

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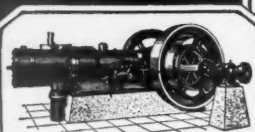
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How long does it take to start your power plant in the morning? Where PRIMM Oil Engines are on duty the operator comes to work with the other employees, and in 10 minutes maximum power is being delivered. This is one of many PRIMM advantages. Others are cheaper fuel—no shutdowns—no dirt or ashes—lower power costs—steady dependable power at all times.

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Built in sizes from 20 to 300 H.P. to meet all power requirements

*"Service Built In At The Factory -
and Maintained In The Field"*

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EXPLOSIVES

for quarrying



QUARRYMEN in every section of the country are adopting Atlas Ammite as their all-year-round explosive. Their attention was first attracted to this Atlas product as a winter explosive—Ammite cannot freeze. But its remarkable efficiency recommended Ammite for more than cold weather work. It often does the work better and at lower cost than ordinary explosives and it will not cause headaches when handled in large quantities. Let the Atlas Service Man show you how Ammite may be made to save money on your work.

AMMITE

—the all-year-round explosive—

ATLAS POWDER COMPANY
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HERRINGBONE GEARS



Falk Herringbone Ball Mill Gears—17 and 267 teeth;
2 D. P., 16 inch face

Smooth Power Transmission

Falk Herringbone Gears are the ideal equipment for gearing down high speed motors to the speed of the driven machinery. They are being widely used on grinding and pulverizing machinery, such as tube mills, ball mills, conical mills, etc., and on hoists, compressors and centrifugal pumps.

By eliminating vibration and reducing power loss to an absolute minimum, they afford the highest overall mechanical efficiency which it is possible to attain in transmitting power.

Our engineering department will be glad to consult with you on your particular problems.

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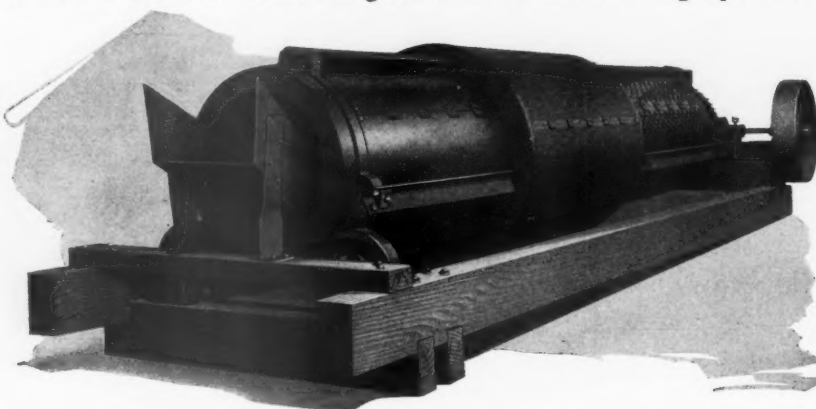
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TOEPFER Combination Scrubber and Screen

The Toepfer heavy-duty combination scrubber and screen is built for the pit where the large capacity of a machine of this type is very desirable.

The construction of this combination is similar to our regular screen, excepting the blank washing or scrubber section, which is fitted with steel angles inside running longitudinally with the scrubber section. These angles facilitate the washing operations, raising and dropping the material and water continually, making a perfect separator, thereby assuring a clean product with less power and water, and in a smaller space than is required for any other type of scrubber.



The construction is simple and durable—nothing to get out of order and make trouble.

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For Handling the Materials Mechanically

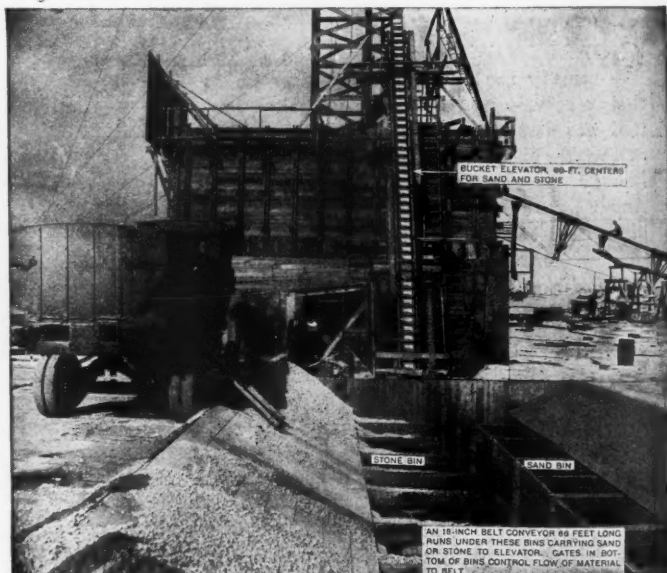
Increase the Output and Reduce Costs by Employing Weller-Made Machinery to Do the Work

It is sturdy and reliable. Never lays down on the job. The cost of operation is small. Will help pay dividends.

We Make
Conveyors of All Types
Bucket Elevators Portable Elevators
Steel Storage Bins Bin Gates
Screens Sheet Metalwork, etc.



Write and let us know the kind of equipment you are interested in or the material you want to handle. Catalogues showing installations, also data to help in selection of equipment, will be sent.



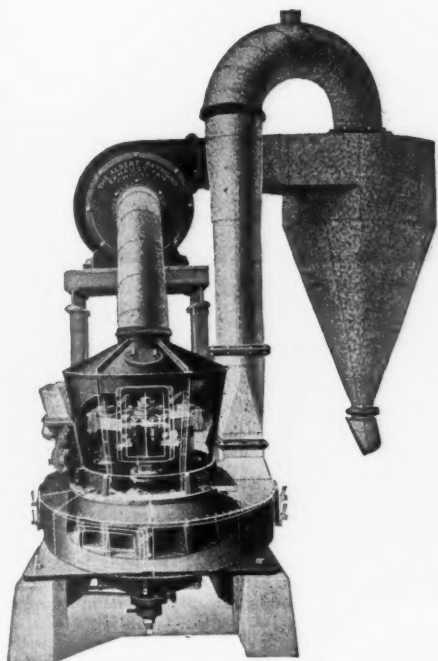
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When one of the leading cement companies in this country purchases 15 Raymond Roller Mills over a period of 15 years to replace other equipment for grinding their coal, it is pretty good evidence that these mills have proved the most economical equipment for this work.

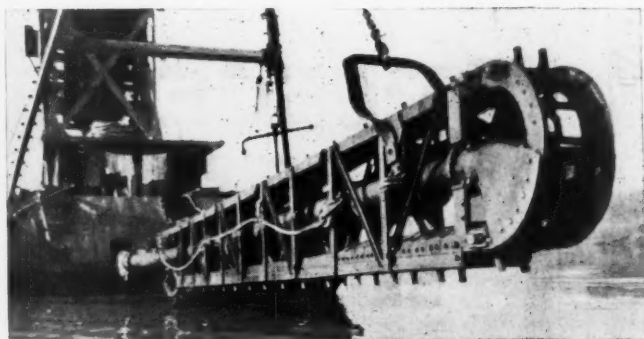
Raymond & Bros. Impact Pulverizer Co.

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CHICAGO, ILL.

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"Increased Our Output 50%"

THIS is the age of efficiency. Production is at a premium. The wide-awake producer knows that in order to make a profit he must stop production leaks. Viewing the situation from this point, we present the following statement, with the assurance it tells a convincing story of economy in production.

"We installed a Swintex Traveling Suction Screen on our 12-in. pump last August and have been able to increase our output 50 per cent. Up to date the screen has met our every expectation."

Granite Sand and Gravel Co.,
Geo. V. Miller, Gen. Mgr.

When any kind of equipment increases production 50 per cent, that equipment is deserving of your serious consideration.

Perhaps it will help you. Write for complete information.

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Flirting With the Shovels

In the game of crushed stone quarrying a drill that is within flirting distance with steam shovel or the loading gangs is in a dangerous position. A breakdown on the drill, and the whole production schedule is upset.

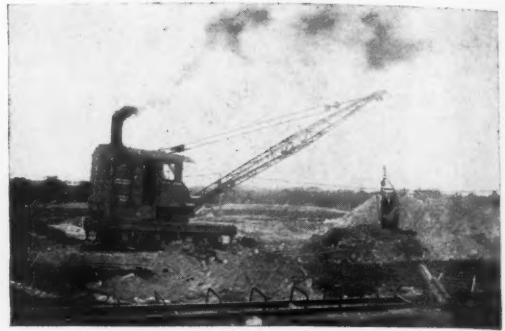
No. 14 Cyclone Drills, on the job, always keep plenty of stone ahead, and if they should ever be crowded there is no need for worry—the working parts are cast steel, reducing to the very minimum all possibility of breakdowns.

Write for "Big Blast Hole Drills," a semi-technical treatise on quarry drilling and also containing a complete description of Cyclone No. 14 Big Blast Hole Drills.

The Sanderson-Cyclone Drill Co.

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Steam, gasoline, or electrically operated Locomotive Cranes for bucket, dipper or dragline operation; yard service and construction work; with capacities ranging from 5 tons to 60 tons; booms to suit, varying from 40 ft. to 140 ft. in length.

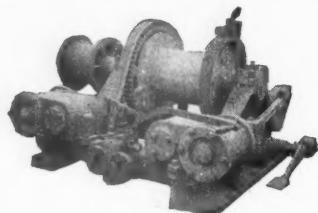
"INDUSTRIAL" Locomotive Cranes are built so as to be readily convertible for various operations. The same Crane may be used for pile driving, automatic grab bucket operation, drag-line operation and for handling heavy loads with hook and block. Booms may be built in sections so that the length may be quickly changed to meet various conditions. The propelling mechanism is of a powerful, sturdy type that makes the Crane efficient in switching and hauling heavily loaded cars.

Your requirements, when submitted to Industrial Works engineers, will receive the benefit of fifty years' experience in the designing and building of material handling equipment.

General Catalogue No. 109, Bucket Catalogue No. 114, and Catalogue 113 describing our CRAWLING TRACTOR CRANE will be forwarded on application.

INDUSTRIAL WORKS, Bay City, Mich.

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Emerson-Brantingham Hoists

UNUSED

**DOUBLE CYLINDER, SINGLE
DRUM, IN FIRST CLASS
CONDITION**

\$150.00 Each F. O. B. Chicago

Capacity, 10,000 Pounds
IMMEDIATE SHIPMENT

**Detailed Specifications Furnished on Application
"QUANTITY IS LIMITED"**

Relaying rails and angle bars, all weights and tonnages,
for prompt shipment. Get our quotations

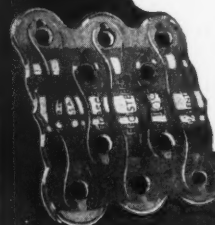
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BELT FASTENERS
MAKE GOOD
BELTS GIVE
BETTER
SERVICE**

**THEY DO
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It will pay you to investigate our exchange proposition on dipper teeth. MISSABE DIPPER—made of AMSCO manganese steel—has all the elements of a great achievement in that it inevitably endures.

AMSCO

"The Steel for Service"

American Manganese Steel Co.

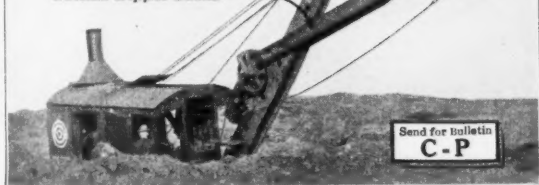
General Sales Office

398 East 14th Street, Chicago Heights, Illinois

Foundries: Chicago Heights, Ill.; New Castle, Del., and Oakland, Cal.

→ A MARK OF SUPERIORITY

All Steel Box Type Boom
Outside Dipper Sticks



This type of boom is lighter and stronger. It is much better adapted to carry the heavy wrenching and twisting stresses of digging. Its greater lightness adds to the ease and speed of swinging.

The outside dipper sticks are less liable to distortion and easier to maintain.

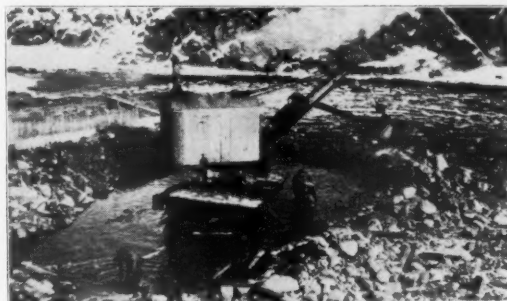
We Know Because We Have Built Hundreds of Both Types

THIS IS A PATENTED FEATURE FOUND ON NO OTHER TYPE OF STEAM SHOVEL

BUCYRUS

Bucyrus Company, South Milwaukee, Wis.

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OSGOOD 29—1 yd., Clearing Channel in Mid-Winter

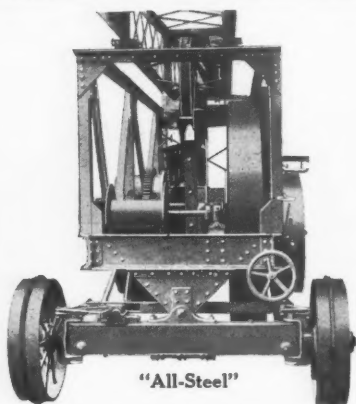
Steady Production

The goal of every plant operator is to keep production moving. The Pit or Quarry operator who uses OSGOOD Steam Shovels is well on the way to uninterrupted production. OSGOOD Steam Shovels are dependable—work day after day keeping up the same large output. Investigate the OSGOOD. Write for descriptive Bulletin. It will interest you. $\frac{3}{4}$ and 1 yd. Revolving and $1\frac{1}{2}$ to 6 yd. Railroad types.

THE OSGOOD COMPANY

Marion, Ohio

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"All-Steel"

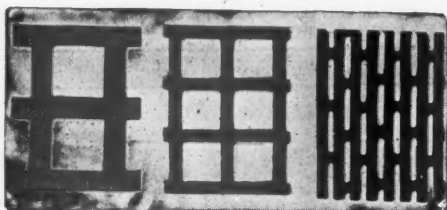
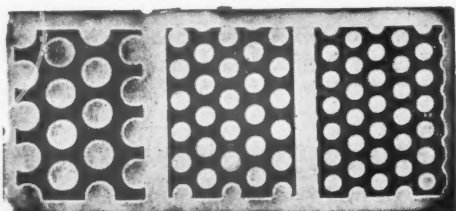
The Drilling Motion

of the ARMSTRONG ALL-STEEL BLAST HOLE DRILL is obtained by direct drive from the crank on the Band Wheel Main Shaft and is easily and positively controlled by the Armstrong Patented Band Wheel Clutch, which is guaranteed for the life of the machine. The Band Wheel is mounted between two steel mail sills. No expensive clutch troubles, no side draft, no overhang, always in perfect balance and ready to go. Sold on terms and 30 days trial.

Bulletin No. 81—a booklet that tells the story—is FREE and worth having. Write for it today and get started on more economical drilling days.

ARMSTRONG MANUFACTURING COMPANY
310 Chestnut Street
Waterloo, Iowa

Perforated Steel Screens



For Screening Stone, Gravel, Sand
and Cement

All sizes and shapes of holes in metal of proper thicknesses to give the best screening results.

Sheets furnished flat or rolled to shape for revolving screens.

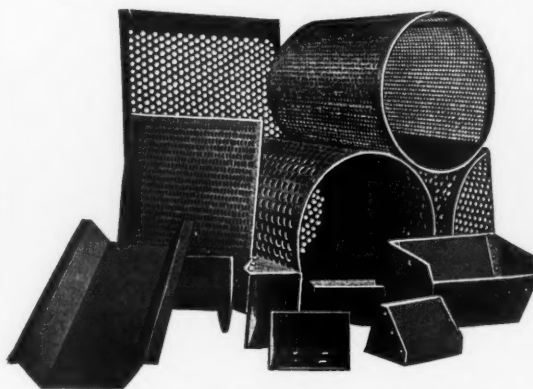
THE HARRINGTON & KING PERFORATING CO.

621 N. Union Ave., Chicago, Ill.
NEW YORK OFFICE: 114 Liberty St.

Perforated Metal Screens

FOR

Stone, Gravel, Sand, Etc.



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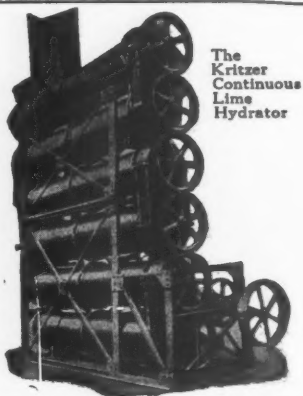
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General Sheet and Light Structural Work
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HENDRICK MFG. CO.

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The
Kritzer
Continuous
Lime
Hydrator

HYDRATE

Years ago we helped our customers create a demand for their hydrate. Today the demand exceeds the supply. That's why every lime manufacturer should have an efficient, economical hydrating plant.

THE KRITZER Continuous Lime Hydrator is efficient in production and economical in operation and maintenance. Let us investigate exhaustively the local conditions peculiar to your proposition, and then apply our experience of many years and design a plant to meet those conditions.

A KRITZER plant, scientifically adapted to your conditions, will give you the best product at lowest cost

THE KRITZER COMPANY

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The ROBINS 20 ft. PORTABLE

\$527.00 F. O. B. Passaic, N. J.

A Troughed Belt Conveyor—No Skirt-Boards

This makes it possible to handle sand, gravel, crushed stone, and other abrasive materials without damage to the edges of the belt.

Features:

16" Troughed Belt, large carrying capacity.

Self-cleaning arched frame, fully protecting the return belt from dirt accumulation.

Rugged construction, well balanced.

Power—2 H.P., A.C. motor, 2 or 3 phase, 60 cycle. If equipped with 5 H.P. "NEW-WAY"

Engine—\$81.00 additional, f. o. b. Passaic.

Robins Conveying Belt Company

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Stands the Grind—



Back of the name ERA is a long record of remarkable economies of both time and money.

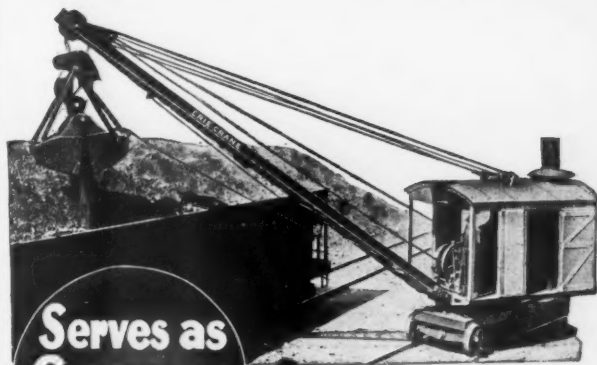
Made of manganese steel, these parts stand up under the grind imposed upon them by the unusual conditions encountered in the production of non-metallic minerals.

They always give the kind of service that eliminates costly shut-downs. Let us know your requirements.

Gyratory Crusher Parts—Heads, concaves and renewable mantles, gears and pinions and wearing plates. Jaw crushers—jaw plates, cheek plates, toggle and toggle bearings. All sizes of standard detachable chain, sprocket wheels and elevator buckets.

The Hadfield-Penfield Steel Co.

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**Serves as
Crane or
Steam Shovel**

Every ERIE can be quickly and easily changed over to a Locomotive Crane. Gives excellent service with clamshell bucket — excavates gravel, loads cars, handles storage, etc.

In the hardest steam shovel service, gravel producers and quarrymen have found the ERIE very sturdy and reliable.

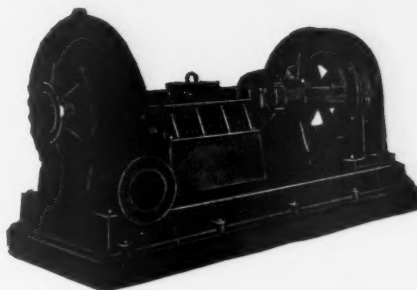
"Our first ERIE has been digging hard gravel for 3 years without any repairs. We have in the past operated other steam shovels that are good, but the ERIE is the best, being by far the most substantial." Write the Standard Builders' Supply Co., Grand Rapids, Mich. They own 2 ERIES, a Steam Shovel and a Crane.

Write for Bulletin P-16, showing just what you can do with the ERIE, both as crane and steam shovel.

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Builders of ERIE Steam Shovels and Locomotive Cranes

ERIE Revolving Shovels



Heavy Service Dredging Pump

Where conditions are too severe for our standard sand pump, the above type is recommended.

It is built in sizes from 4 in. up, arranged for belt, motor, or engine drive.

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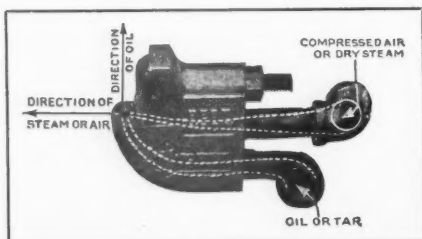
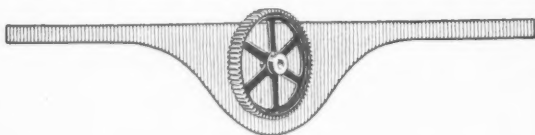
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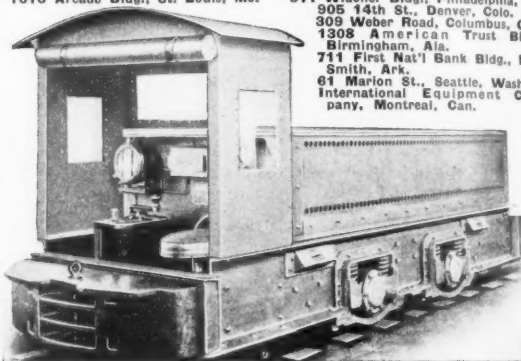
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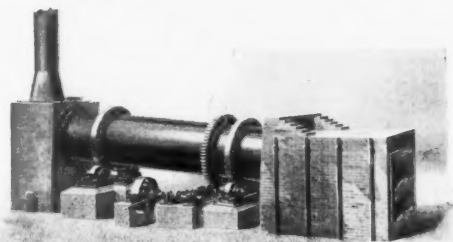


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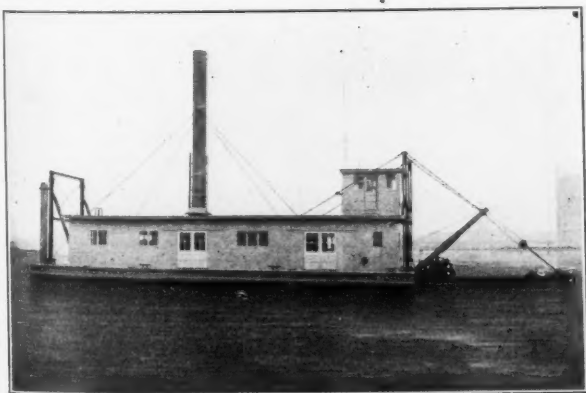
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Newark wire cloth is a product that renders high-class service. It is always reliable, and measures up to all claims made by this company. We combine an able personnel of long experience whose desire is to serve the non-metallic industry with a product that will render a full measure of satisfaction.

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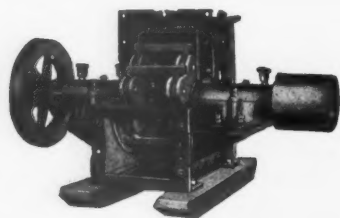
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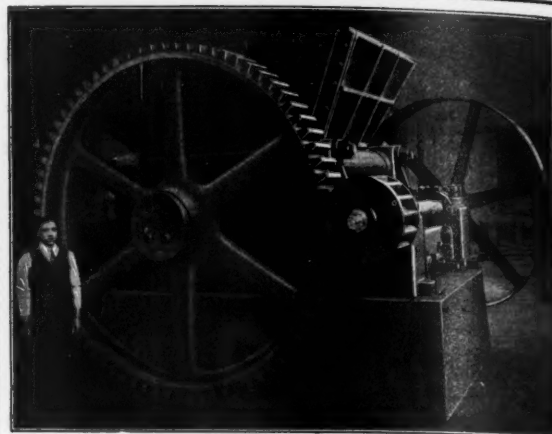
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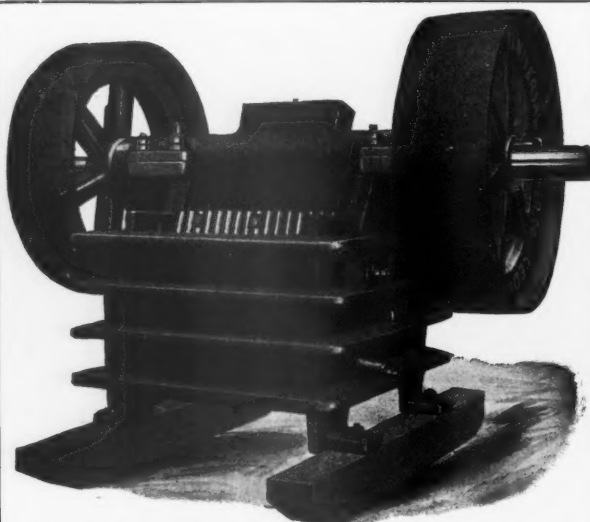
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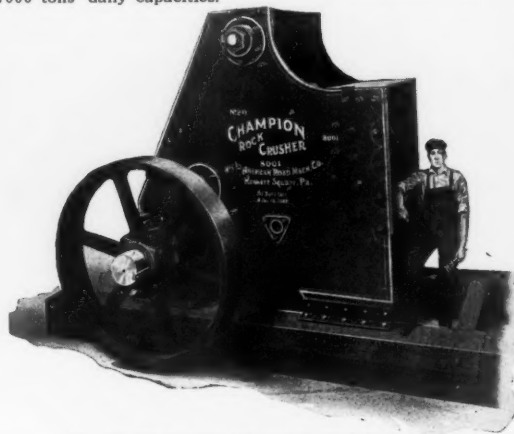
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Thirty Two Years Ago

The First Champion Crusher Was Built

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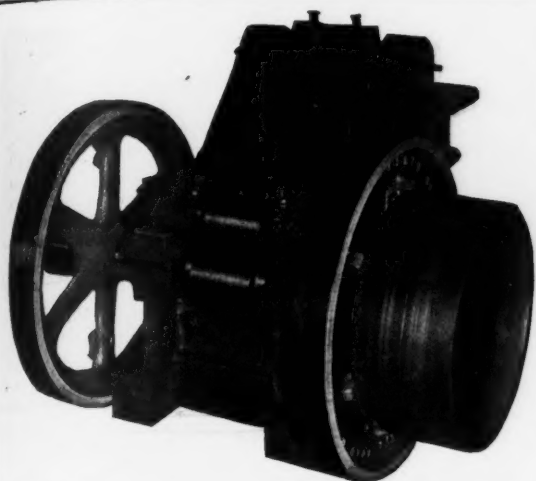
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They have shown it is of the proper design and construction. They have proved it is the best built, most durable and efficient pulverizing machine yet offered producers of non-metallic minerals.

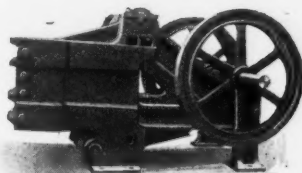
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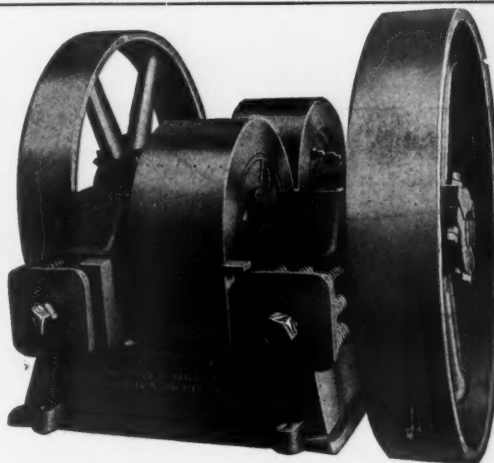
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When you buy transmission equipment, screens, elevator buckets, or crushers of our manufacture, you secure the combined excellence of good material and craftsmanship.

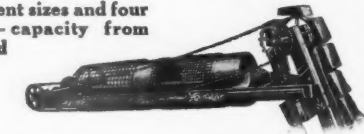
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made in three different sizes and four different lengths — capacity from one to two hundred tons per hour.



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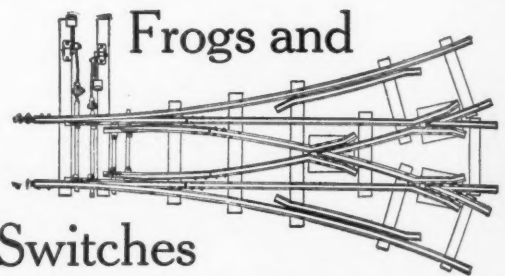
The Byers "Truckrane" can be driven to work just like any automobile. Saves time and expense on every job. One owner recently refused \$50.00 rental per day for a two weeks job in Chicago. Ask for "Truckrane" Bulletin.

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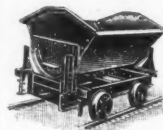
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dig, convey, elevate and dump in one operation

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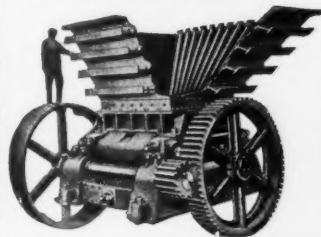
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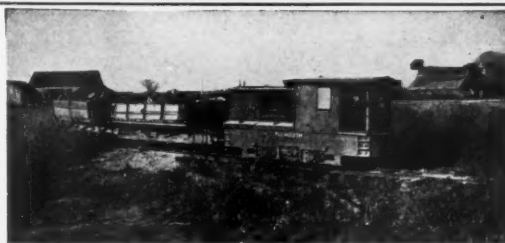
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HUM-MER Electric SCREEN
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 Manufacturers of Woven Wire Screens and Screening Equipment

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- A large stock of repair parts for all mills.
 34 new unpunched tank steel plates, 280"x96"x 9/16" thick. Total weight 154,424 lbs. Just sufficient to roll two 7x110' Rotary Kilns, including butt straps.
- KENNEDY REFRACTORIES CO.**
 Tiffin, Ohio

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| | \$800 |
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| | 1 Vulcan Iron Works Hoist, Drum 5x5', complete. |
| | \$1,250 |

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- 1—Vulcan 8'x100' Rotary Kiln.
- 1—Vulcan 7'x120' Rotary Kiln.
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- Swing Hammer Mills, all makes.
- Buchanan and Sturtevant Crushing Rolls.
- Jaw, Gyratory and Disc Crushers.
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High Grade Used Machinery for the Entire Rock Products and Non-Metallic Mineral Industry Our Specialty

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 - 2-1000 Gpm. Underwriters Steam Pumps, 100 lb.
 - NEW No. 5 GYRATORY CRUSHER (MICHIGAN).
- Send us inquiries for your wants
- Ross Power Equipment Company**
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WANTED

- Gyratory Crusher, 30 or 36 in.
 - 1 Revolving Screen, 48 in. or larger
 - 24 and 30 in. Conveyor Carriers
 - 1 Small Revolving Steam Shovel
- Beverly Stone & Sand Co., Liberty, S. C.

FOR SALE

- No. 5 Gates Gyratory Style D Crusher.
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- Two Climax No. 2—9x16-in. Jaw Crushers.
- 70 H. P.—13x16-in. Erie City Steam Engine.
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International Silica Company
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Second-Hand Price

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These Dryers were about to be put into operation as the armistice was signed, and consequently were never used. We are offering them at a sacrifice, complete with driving mechanism, furnace irons, grates, etc. Some are equipped with steam radiators for steam heated air drying.

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- 7—Sets 40x15 in. Anaconda Crusher Rolls

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- 1—100C Bucyrus 3½ yd. Dipper
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- 2—70C Bucyrus 2½ yd. Dipper
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- 8—14x22, 40-ton, 4-wh. American
- 2—14x22, 40-ton, 4-wh. Baldwin
- 5—13x18, 30-ton, 4-wh. American
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Both priced low and for immediate shipment.

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About ten miles from Asheville, North Carolina, a growing city and on the Southern Railway and a hard surfaced road leading to Asheville, with ample water for washing, cleaning and separating the sand and gravel. I control about 150 acres of this deposit, running from a depth of 8 feet to a maximum of 27 feet deep, and averaging more than 15 feet deep all over this acreage.

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542 South Dearborn Street, Chicago, Ill.

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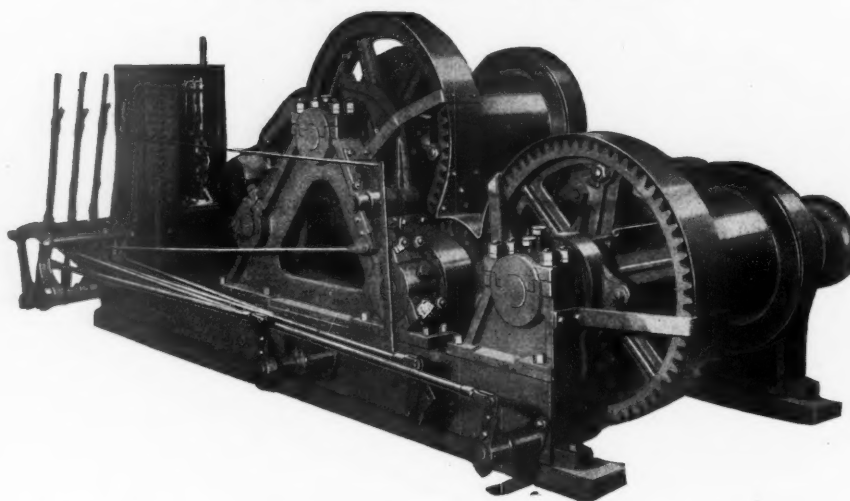
Analyses, consultations, researches in connection with rock products, cements, clays, lime, plasters, zeolites, sands, etc.

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Webster Continuous Bucket Elevators

are used primarily for handling sand, gravel, stone, lime, etc.

They are built in many different lengths and capacities to suit the requirements of the individual plants.

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No. 1 Capacity: Equipped with 30' boom. Handles 3/4 yard bucket at 25' radius; lifting capacity at 12', 14000 lbs. 4 cylinder 5'x6' gasoline engine.

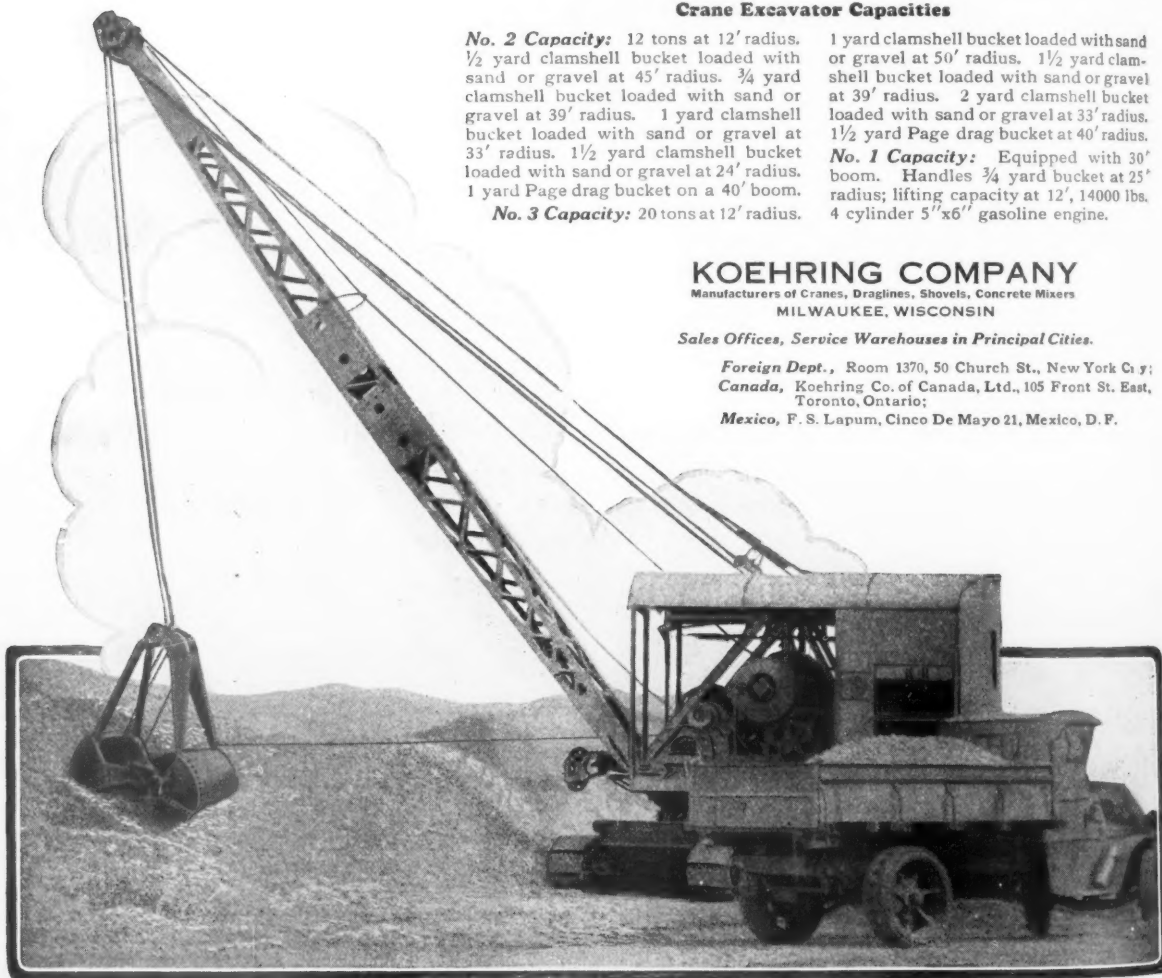
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Works with—

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Magnet, Shoveling
Attachment, etc.

Operates by—

Steam
Gas Engine
Electricity



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Products: Locomotive Cranes, Buckets, Chain and Belt Conveyors, Storage Bins, Etc.

BROWNHOIST

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Rock Products

Entered as second-class matter, July 2, 1907, at the Chicago, Illinois, Postoffice, under the Act of March 3, 1879.

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Number 10

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Putting greater Power in the thrust—

THE outstanding success of the Northwest in stone quarries is explained by a number of advanced features.

Foremost among these is the simple arrangement of cables which eliminates gears, racks, pinions, auxiliary motors and auxiliary drives. With this arrangement there is positively no reduction of digging power while hoisting—an advantage not shared by other shovels. There is nothing to wear out but the long lived cables.

Ideal flexibility in every operation—thrusting in or out, swinging and shaking the dipper—is provided by this simple mechanism, and it is added to by the Northwest patented steering device that makes the crawler as easy to handle and steer as a tractor.

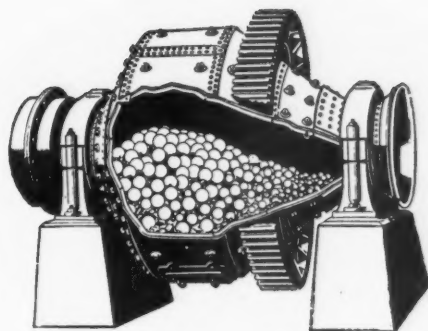
The bucket is $\frac{3}{4}$ yard capacity and has reversible manganese teeth. The shovel is equipped with a 57 hp. gas engine or electric motor of equivalent capacity.

Write for complete specifications.
Why delay?

Northwest Engineering Company
1234 Steger Bldg., Chicago

NORTHWEST
SHOVEL

CRANE
DRAGLINE
SHOVEL



One Company Spent \$750,000 To See If It Could Be Done

Their Tests indicated the project would be a success—They have now installed the first section of a proposed \$50,000,000 plant—The greatest undertaking of the kind the world has ever known.

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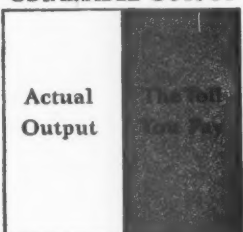
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Hardinge Conical Mills

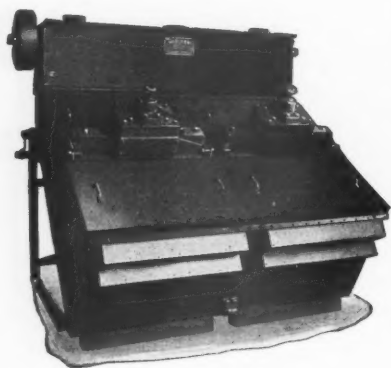
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The "Toll Gate" in the Grinder!



Type 31
6-Foot, Two Surface
HUM-MER Electric Screen

Many plants have toll gates in their grinding equipment in the shape of internal screens. Just as the toll gate of by-gone days held back and hampered transportation, so internal screens hold back the material and limit the capacity of the grinder to the capacity of the screen. Toll is exacted by greatly reducing the possible tonnage.

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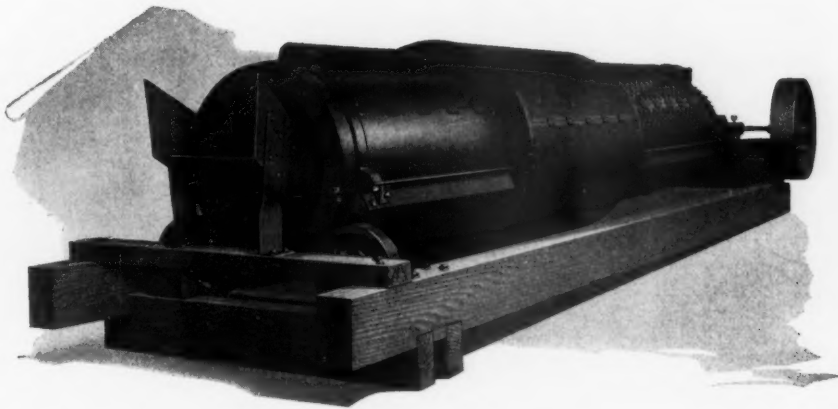
Let us show you how much toll you can save and how much profit you can reap by installing HUM-MER Electric Screens in connection with your grinders.

Request Catalogue 45-R

THE W. S. TYLER COMPANY, Cleveland, Ohio
Manufacturers of Woven Wire Screens and Screening Equipment



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With the exception of the blank washing or scrubber section, this combination is similar in construction to our regular screen. The scrubber section is fitted with steel angles running longitudinally, which facilitates the washing operations, raising and dropping the materials and water continuously, making a perfect separation and assuring a clean product, with less power, less water, and using less space than is required by any other type of scrubber.

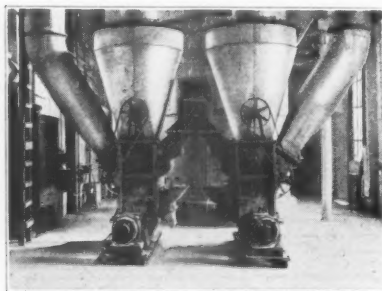
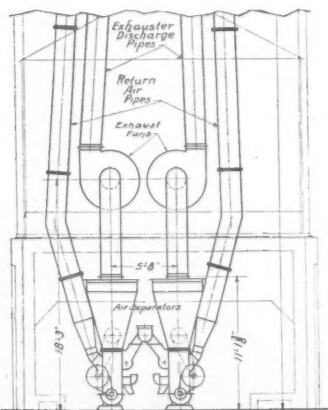
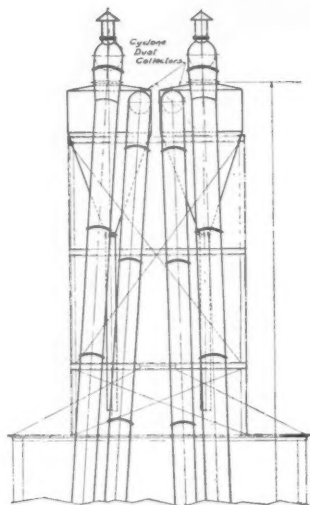
There is nothing to get out of order, nothing to make trouble. The construction is simple and durable.

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Milwaukee Wisconsin

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Nine Lime Companies Have Ordered Raymond Equipment for Their Hydrate Plants Since the First of the Year



Two Special No. 3 Pulverizers in the plant of the American Lime & Stone Co., Bellefonte, Pa.

The use of Raymond Equipment in Hydrating Plants is almost universal now. It meets the needs of the manufacturer of Agricultural Lime, Chemical Lime and Lime for the Building Industry.

□

Raymond Pulverizers equipped with Air Separation remove the impurities such as core, sand and unburnt material from the Lime, and deliver a fine uniform Hydrate direct to storage bins.

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Raymond Roller Mills equipped with Air Separation grind all of the Lime, including the impurities, to a fine powder and deliver the material direct to storage.

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No matter what your requirements are, they can be met by Raymond Equipment.

Raymond & Bros. Impact Pulverizer Co.

1301 N. Branch St.

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THIS is a special advertisement, printed for the **younger men** who use steam shovels and cranes—the men who have started in construction work within the past few years. If you have been in this line of work for ten years or so, these questions and their answers will be an old story—you need not read any farther **unless you want to refresh your memory.**

Who was the first steam shovel builder to use 3-lever control—making it easy for one man to govern the entire shovel operation, with only 3 levers instead of 4, 5, or 6 levers?

Who was the first to rate a $\frac{3}{4}$ -yard shovel to dig 50 to 60 cu. yds. an hour in bank work, instead of 30 to 40 cu. yds.—and then have many yardages run above the new high rating?

Who was the first to provide a reliable swinging mechanism with the load carried between large bearings—a swinging mechanism which was not frequently breaking down?

Who was the first steam shovel builder to provide an auxiliary exhaust, so that forced draft may be used only when the fire requires it?

Who was the first to provide steam shovels with a worm-gear-driven power-operated boom hoist?

Who was the first to fit the dipper handle with wear-resisting drop-forged racking which lasts as long as the dipper handle itself?

Who was the first to use a shipper shaft and pinion cast in one piece—much stronger construction, and costing no more than a pair of pinions only?



It pays to use equipment that is "ahead of its time"

Who was the first to build a $\frac{3}{4}$ -cu. yd. steam shovel with long enough reach to dig an 8-ft. cellar without bringing the wagons down into the hole?

Who was the first to build a real $\frac{3}{4}$ -yd. steam shovel easily convertible to a real practical locomotive crane, highly efficient on clamshell and dragline work?

Who was the first to use an indestructible one-piece open-hearth steel truck frame, with all the bearing boxes an integral part of it?

Who was the first to provide a traction wheel shovel with a power steering device that could be hooked up in about 10 seconds, instead of as many minutes?

Who was the first steam shovel builder to use a center pin easily removable from above, making it easy to dismantle the shovel without jacking up the cab over the center pin?

Who was the first to provide steam shovel engines with dust-proof covers to keep out dirt and grit?

Who was the first to reduce vibration of the hoisting engines by tying the cylinders together, with a rigid bridge forming the cylinder head and central reverse valve chest?

Who was the first to build steam shovels on the interchangeable duplicate plan, ensuring perfect fit of renewal parts?

Who was the first steam shovel builder to use case-hardened eccentric pins, cross-head pins, and lever connections—eliminating rapid wear and lost motion?

Who was the first to use bent piping instead of fittings—and flanged pipe connections instead of direct tapping into large castings?

Who was the first to set the hoisting engines back of the center pin and make the cab roomy, with all working parts easily accessible?

Who was the first to strengthen the general-purpose steam shovel dipper, and increase its opening clearance, by **building the bail into the dipper?**

Who was the first steam shovel builder to provide, as standard equipment, an automatic trip-rope tightener to keep the trip rope taut and speed up the dumping?

Who was the first to make a hinged stack easily thrown back to expose every tube in the boiler, for easy tube cleaning?

Who was the first to build a steam shovel caterpillar type mounting with durable steel treads—steered by power—fully lubricated at every bearing point—and in every way as reliable as traction wheels? (There are now more than 700 caterpillar type ERIES in service.)

The correct answer to every one of these questions is "ERIE"—as is well known by all of the "old-timers" who have kept in close touch with steam shovel progress.

AND THESE ARE ONLY A FEW of hundreds of important improvements—actually **hundreds** of them—all made by the same "who". Numerous improvements which have given the ERIE Shovel a wide reputation for greater output and **UNEQUALLED RELIABILITY.**

The same progressive designers are still on the job here. They have marched in front during the past ten years, and are not content with any place except at the head of the parade.

When you buy an ERIE Shovel or Crane, you get a machine that is actually several years ahead of its time. **It pays to use machinery like that.**



ERIE STEAM SHOVEL CO., Erie, Pa., U. S. A.

Incorporated 1883. Formerly BALL ENGINE CO.

Builders of ERIE Steam Shovels, Locomotive Cranes, Railway Ditchers

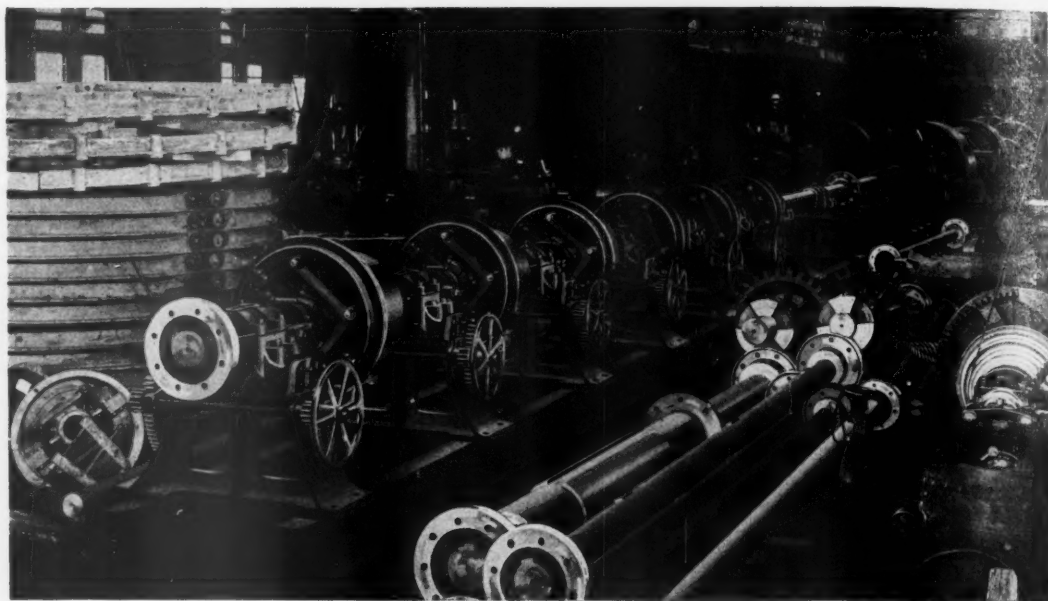
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Send for this book today. It contains information you should have

A complete installation backed by one responsibility

This complete cement mill line shaft was designed by Dodge engineers, built in the Dodge shops and assembled as shown for an actual running test before shipment.

These careful methods assure in the completed installation, the satisfactory performance of every unit and the saving of time and delay in erecting the job.

Dodge friction clutches have passed every test demanded by cement mill service—for dry pans, tube mills and other machinery operating intermittently they make big savings in power as well as preventing costly shut downs and delays.

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Power Transmission Machinery

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Building the Appian Way

Late in the fourth century B. C., Appius Claudius began a campaign for a road which would connect Rome with its southern provinces at Brindisi. The Roman Senate for a time balked at the great expense. Finally, Appius Claudius agreed to defray part of it from his own vast fortune.

Grading and digging stone for the road bed and pavement of this famous highway begun in 312 B. C. was a long, laborious task, which required thousands of soldiers and slaves.

The digging had to be done by hand. To obtain paving stones, slaves cut channels in the basalt to the required depth around the block, and then pried it out with iron bars. The smaller stones for ballast were chopped out with picks and hammers.

Appius Claudius cared little for time and labor. The cost of his methods would be prohibitive to the modern contractor, quarryman, or mine operator. Today, even dynamite, the great labor saver of this age, which has made possible a highway to the summit of Pikes Peak, has to be scientifically selected.

For work on which it is suited, Hercules Special No. 1 reduces blasting costs. It contains one-third more cartridges per case than 40% dynamite which it usually replaces, cartridge for cartridge, at a saving of about twenty-five percent. Hercules Special No. 1 contains nothing but the highest grade of standard materials and has thoroughly proved its dependability.

Write to our advertising department 945 King Street, Wilmington, Delaware, for a booklet on "Eliminating Waste in Blasting".

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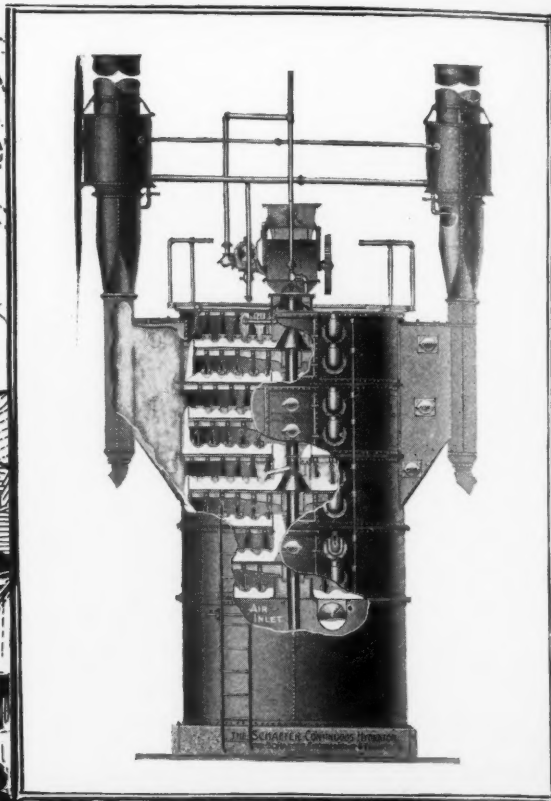
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OPERATING ECONOMY

Lime and man have given this machine a strenuous testing. Years of service in the employ of the lime industry has conspicuously demonstrated the remarkable efficiency and economy of this machine.

The Schaffer Continuous Lime Hydrator is built in three sizes, ranging in capacity from a few tons to twenty tons per hour.

It will work successfully under the most adverse conditions, and its exceptionally flexible control, enables it to produce either high calcium or dolomite lime with equal success.

Automatic in operation

Schaffer Engineering & Equipment Co.
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